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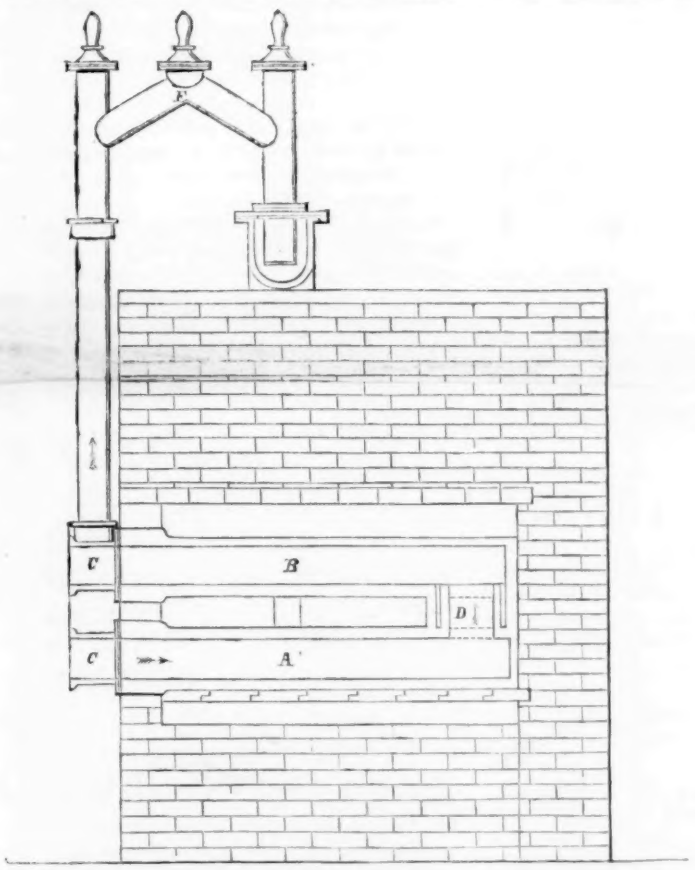

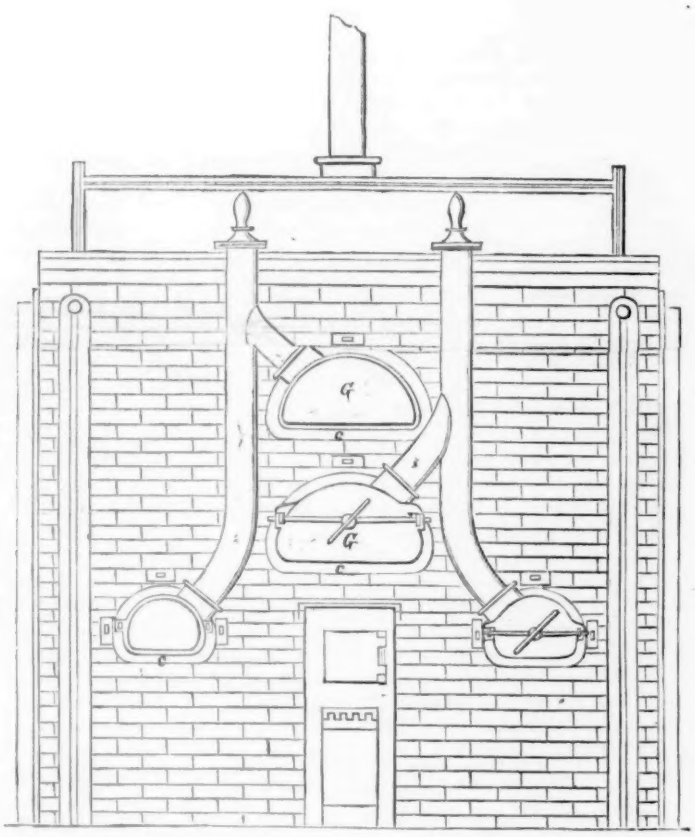

The Elmer Process of Gas Manufacture.

The bench represented in these cuts consist of four retorts, two of which are clay and two iron. The iron retorts are placed horizontally over the fire in the center of the arch, one above the other, as shown in the front elevation. These retorts are designed to hold as much coal as an ordinary bench of five fire clay retorts.

At the extreme back end of these retorts, on the opposite side of each, is a curved outlet to receive a vertical 8-inch pipe. which extends upward through the arch of the bench. In each of these pipes is inserted a 3-inch pipe, which extends to, and connects with, the hydraulic main, for the purpose of returning to the iron retorts any condensable matter that has escaped conversion into gas.

The clay retorts have the form of a boot, consisting of a horizontal and vertical portion. These retorts are placed on either side of the iron retorts. By means of nostrils in the furnace the heat is projected directly upon, and circulates around, the clay retorts, until it arises at the top of the vertical portion of the retorts; entering then the arch containing the upper iron retort, it circulates around the same, and is conveyed to the front of the bench, where it passes through a flue on each side of the arch containing the lower iron retort, circulates around it, and passes to the back of the bench, where it escapes into the main flue.

By this means the clay retorts are heated to a high or white heat, while the iron retorts are heated only to a low or cherry red heat. The clay retorts are connected with the hydraulic main at the top of the bench, by ordinary bridge pipes.

The iron retorts are connected with the clay retorts at the front of the bench, as shown in the front elevation. The volatile matter eliminated from the coal, while in the state of vapor, passes through the connecting pipes directly into the clay retorts, where, undergoing high heat, it is converted into gas.

A modification of this bench has been devised by Mr. Goodwin, as being better suited to the existing arches of ordinary gas works. In this modification the vertical part of the secondary retorts is suppressed, or rather replaced by an additional horizontal attachment, the full construction of which will be specified hereafter.

A NEW APPARATUS for detecting the presence of fire-damp in mines has been recently introduced in Germany, which is thus described: It consists of a bell actuated by clock-work, the striking motion being checked by an unevenly balanced arm, the lighter end of which is held by a cotton thread saturated with saltpetre. The apparatus is placed in a wire gauze cage. The fire-damp, when it occurs, penetrates with the air into this cage, and quickly ignites from contact with the flame of a lamp burning within, and, as a necessary consequence, burns the thread, setting free the balanced arm which checks the bell, which then rings the alarm. This device seems simple, and may be easily tried.—*Am. Exchange and Review.*

Chemical Repertory.

No. 75.—September 2, 1872.
EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

419. Spectroscopic.—Pluecker, Wuellner, and others, have cast a damper on our ordinary spectroscopic theories by maintaining, and apparently proving, that a single gas, when incandescent, may give numerous spectra, varying with the temperature. Angstroem has lately combatted all this, in a communication to the French Academy, asserting that hydrogen, for example, has, when pure, but one spectrum, that namely which is observed in the light of the sun and the stars. One of the spectra attributed by Pluecker to this gas is that of acetylene, another that of sulphur. In the case of oxygen, for which Wuellner found three spectra, one is asserted by Angstroem to have a great analogy with that of carbonic oxide, another is the spectrum of chlorine

420. Dissociation of Sulphuretted Hydrogen.—The books state that this gas is decomposed only at a red heat. J. Myers finds, however, that it is separated into its elements already at 400° C (=750° F.), and at the boiling point of sulphur the decomposition is considerable.

421. Newspaper Science.—From an article on the putative Arizona diamonds, we rescue the following gem: "Nature, on the other hand, works very cheaply, and uses the cheapest and commonest materials. She makes the diamond out of the same substance of which she makes our ordinary charcoal; she takes a little of the glazing which the potter uses in his daily operations, and, coloring it with a trace of iron, produces a ruby or a sapphire: while from the commonest quartz, with very slight additions and manipulations, she yields us the topaz, the emerald, and the amethyst. We may not hope to emulate these thrifty processes."

[Doubtless we may not, nor Nature either.]

422. Improved Gas-Fire—Patent granted in England August 21, 1871, to John Robert Breach, of 4, Bridgewater Square, Barbican, in the city of London. The inventor has discovered that by making an apparatus of two pieces of fire-clay or fire-brick, one p ece solid, and the other piece so as to cover the underpiece, but leaving a space of about half an inch between the two, through which the fire from several gas-jets, or the flame from paraffine oil, or other similar agent, is directed, that a fire-bright red is produced, but without any unpleasant smell, such as is usually given off from ordinary gas-stoves. The apparatus is made to fit the ordinary fire-places, so that the many advantages of such a fire are secured without any apparent difference in the room from the ordinary coal fire.

423. "Distillation by Cold."—Alfred H. Smee, the inventor of the voltaic battery named after him, has communicated to the Royal Society a method which he has devised, and which he names "distillation by cold," by which he believes the detection and determination of ammonia and other organic impurities existing in the atmosphere will be greatly facilitated.

A glass funnel—usually of 8 or 9 inches—is drawn to a point and closed. It is supported in an ordinary stand, and filled with ice. Condensation of the watery vapor of the atmosphere then takes place; the dew collects into drops, which trickle down the outside of the funnel, and at last fall from the point, under which a small receiver is placed to catch them. The total quantity of liquid collected in a given time is measured, and the quantity of ammonia determined by Nessler's test.

By the method of distillation by cold, the author found it possible to distil many substances which are decomposed at a high temperature. Thus many delicate odors of flowers were distilled by placing the flowers under a bell-glass sufficiently large to cover the funnel containing the ice. The odors were found to be more rapidly and completely abstracted by placing a dish with a little ether under the bell-glass at the time of distillation.

The paper was accompanied by tables giving the results obtained in 107 experiments, together with the atmospheric conditions prevailing at the time. The experiments were made in a garden, in a bed-room, in hospital wards, in the open country, etc. A few of the numbers obtained are here given by way of example:

Fluid collected, in minims.	Ammonia in grs. per gallon.	Source.
150	1·9742	Erysipelas.
120	0·1791	Garden.
55	6·8807	Drains.
90	2·1000	Bed-room.
	2·9568	Stables.
150	0·0985	Victoria Park.

424. "Hydroscopy."—A Frenchman by the name of Paramelle has been devoting himself to the scientific study of subterranean waters, the kind of ground where they are to be found, their flowing, the physical laws that govern their abundance or scarcity, and their depth The science is now said to be complete, and has been christened "hydroscopy," or subterranean hydrology. Its applications are definite, and among them we must place in the first rank the discovery of springs and well sites. Within easy access of every villege, almost of every house, and generally at a little depth below the surface of the soil, there exist streams of water. By a simple digging (indicated after a thorough survey of the place, and not by the aid of the divining rods, which have made so many dupes), one can channel out the hidden streams, and make them flow to the surface; or else a well can be dug which will furnish an abundant supply of water. Paramelle has already, it is stated, discovered 9,500 springs in France, and his disciples have been equally successful.—*Amer. Artisan.*

425. Chemical Agents on Paraffine.—The popular notion about paraffine, from which its name was derived, is that it is insensible to all ordinary chemical agents. Chemists, however, tell a different story. P. Champion, by the prolonged action, aided by heat, of nitrosulphuric acid upon paraffine (the variety prepared from boghead mineral, fusing at 53°) obtained paraffinic acid, a fluid which does not solidify at −10°; sp. gr. at 15°=1·14: it is insoluble in water, but soluble in ether, alcohol, wood-spirit, and amylic alcohol; its reaction is acid; it burns with a luminous flame; it is soluble in and forms compounds with ammonia, soda, and potassa; formula, $C_{26}H_{27}NO_{10}$. Its composition in 100 parts is—Carbon, 56·53; hydrogen, 9·42; nitrogen, 5·07; oxygen, 28·98. The soda salt of this acid is soluble in water, but the baryta and silver salts are insoluble in that fluid. The ethylic salt of the paraffinic acid is a solid body, soluble in alcohol and ether; formula, $C_{26}H_{25}(C_4H_5)NO_{10}$. The properties of the methylic and amylic salts of this acid agree with the ethylic salt. By causing nitrosulphuric acid to act for ten days upon paraffine a compound $C_{22}H_2NO_{12}$, is obtained. Paraffine is readily and rapidly acted upon by fuming nitric acid at 110° under pressure. The action of chlorine, bromine, and iodine upon paraffine is briefly alluded to; the two first named haloids appear to form compounds with paraffine, but, even at 100°, iodine scarcely acts upon paraffine.—*Acad. of Sciences.*

426. Heat and Pressure on Paraffine.—T. E. Thorpe and J. Young.—After briefly referring to a memoir on this subject read at a meeting of the Royal Society, the authors state that they have made experiments on the joint effect of pressure and heat upon paraffine on the larger scale. Three and a half kilos. of paraffine (fusing at 46°, sp. gr. at 13=0·906) yielded about 4 litres of fluid hydrocarbons, of which 0·3 litre boiled below 100°, 1·0 litre at from 100° to 200°, and 2·7 litres at from 200° to 300°; there remained a solid residue in the retort, which, on being treated with ether, was found to have as constant melting-point 41·5, and to consist, in 100 parts, of—C, 85·19; H, 15·34. By the action of bromine, this body was found to belong to the $C_nH_{2n}+2$ series. The authors next describe the results of the fractional distillation of these fluid hydrocarbons. After treating the liquids thus obtained with bromine, these substances were found to be—pentan, boiling-point 35° to 37°; hexan, 67° to 68°, sp. gr. at 18°=0·6631; heptan, 97° to 99°, sp. gr. at 18·5°=0·6913; octan, 122° to 125°, sp. gr. at 15·6°=0·7165; nonan, 147° to 148°, sp. gr. at 13·5=0·7279.—*Germ. Chem. Soc.*

427. Process of Moulding Silica.—M. Muller.—The silica is reduced to an impalpable powder, which is mixed with water to form a paste, when it may be moulded. Then on being heated to bright red, it fuses together giving a form of pure silica. Even larger grains may be introduced into the mass as they will be fused on the surfaces and agglomerate with the silicious powder.—*Amer. Chem. from French Jour.*

428. Irrigation.—The otherwise arid regions about Salt Lake City have been made to blossom like the rose, by means of artificial irrigation, carried into effect by the Mormons. About two thousand miles of irrigating canals have been projected in California, which will protect ten million acres of land from drought.—*Amer. Artisan.*

429. More Chemistry of Whiskey.—The *explosiveness* of Brooklyn whiskey having been established, it is interesting to know something of another variety. We therefore note the following:

"Everybody knows that whiskey (if drunk in sufficient quantity) is a cure for rattlesnake bites, and now Cincinnati is proud to learn that its peculiar product (under the same condition) is a prophylactic as well. It has been ascertained by actual experiment, that after a man has taken a quart of this wonderful fluid, a rattlesnake will surely die within half a minute of biting him, and if the whiskey don't kill him the bite won't.

430. More About Whiskey.—Dr. Van der Weyde has lately taken us to task for opining that wood-spirit, sometimes called wood-naphtha, stated to be used in Great Britain for adulterating whiskey, is not necessarily poisonous. It seems that the question comes up there before coroner's juries. Witness the following from the London *Globe*:

"An inquest was held yesterday afternoon at Preston, on the body of John Nuttall, whose death was caused through drinking methylated spirits. Dr. Brown attributed his death to alcoholic poisoning. From an examination of the drink he should think it was whiskey considerably above proof. The jury returned the verdict that the deceased died from drinking an excess of distilled spirits, not knowing the strength of it."

431. Carmine Lakes.—These very beautiful pigments are prepared from a decoction of cochineal, and not from carminic acid, the animal matter which the insect contains, appearing to be necessary to their production. The mode of preparing the finest qualities is kept a secret by the manufacturers; but I will describe two processes which give very satisfactory results. The first consists in boiliog one pound of ground cochineal with two gallons of water, to which has been added one ounce of alum. It is then boiled for three minutes, the liquor is allowed to settle, and, after having been kept for several days, about one ounce of a bright carmine lake is produced. For the alum employed in this process cream of tartar can be substituted. The second process consists in boiling for three hours two pounds of powdered cochineal in thirty gallons of water. To this is added three ounces of pure saltpetre. The liquor is then boiled again and left to settle. The clear liquor is run off, and after two or three weeks yields a fine carmine lake. As these lakes are expensive, they are often adultera-

ted with starch, kaolin, vermillion, etc. The complete solubility of pure carmine lakes in ammonia affords a ready means of detecting these adulterations. —*Crace Calvert.*

432. Remarkable Occurrence.—*Serious Explosion of a Steamer.*—On Tuesday last a serious explosion occurred on board the screw steamer "Torino," lying at Tyne Docks, South Shields. The vessel was loading gas coals, and the cook and two seamen went below to get some provisions, carrying with them a lighted candle. They no sooner got below than a terrific explosion took place from the gas generated from the coals. The men were knocked down and dreadfully burned in all parts of the body. One of them is not expected to live. They were conveyed by special train to the Newcastle Infirmary. On the explosion taking place the steamer took fire, which was extinguished by means of the water hose. The steamer is considerably damaged by the casualty.—*Lond. Jour. of Gas-Lighting.*

433. The Cincinnati Water and Gas Works.—In a letter from Prof. Thurston to the *Scientific American*, he says: "After visiting the water works, where we found five steam engines engaged in supplying the city with water, and where we were especially interested in the working of the largest—a great machine, 100 inches in diameter of cylinder and of 12 feet stroke of piston—we accepted the invitation of Mr. E. M. Breese, the engineer of the city gas works, and, under his guidance, examined that great establishment very minutely. Space will not, however, allow of a description of this or of other interesting establishments which may be found at Cincinnati. Some idea of the magnitude of the city itself is afforded by the facts, learned at the gas works, that they consume annually about 1,250,000 bushels of coal, making 700,000,000 cubic feet of gas. Such a quantity of coal would warm, for the winter, the houses of about 6,000 New York mechanics, and the volumes of gas made annually is perhaps four times as great as that of the 6,000 houses taken together."

444. Water Meters.—By a supplementary ordinance the councils of Philadelphia grant large water consumers the option of paying according to measure of water consumed, where objections may be made to the present levy of water rent. The ordinance is as follows:

Supplement to an ordinance entitled "An ordinance for the government and protection of the department for supplying the city with water," approved June 1, A. D. 1871, to provide for the use of water meters by special agreement, and fiying the rates therejor.

The select and common councils of the city of Philadelphia do ordain, That when it shall be specially agreed upon between the water department and manufacturers or other large consumers, to accurately determine the amount of water rent to be assessed, the chief engineer of the water department is hereby authorized to introduce meters into such premises, and the charge for water consumed as indicated by any meter, shall be at the rate of one dollar per one thousand cubic feet, payable quarterly.—*Amer. Exchange and Review.*

[From the *Journal of the Franklin Institute.*]

Experiments on Various Coals of the Carboniferous and Cretaceous Periods,

To Ascertain their Relative Potential and Economic Vaporizations. Made by Chief Engineer B. F. Isherwood, *U. S. Navy, at the Mare Island Navy Yard, California, in* 1871.

[Condensed by the Editor of this Journal.]

Results of the Experiments.

Rapidity of Combustion.—The various coals experimented on differed greatly in their rates of combustion, other things equal. Of course, the experimental rates cannot be depended on as strictly accurate, relatively, because the experiments being made at different times, the draught of the chimney was differently influenced by differences in the barometric and hygrometric conditions of the atmosphere, and by the movements of the air, all of which continually varied: still, they approximate accuracy sufficiently for practical purposes. The measure of the rate of combustion will be taken to be the number of pounds of the combustible portion of the coal consumed per hour per square foot of grate surface; that is to say, the number ot pounds of what remains of the coal after deducting its ash and clinker.

In the following table are exhibited these maximum rates, both absolutely and relatively. In the latter case, the maximum rate of combustion of anthracite is taken for unity, as that coal is generally used in the navy, and on the sea-board of the United States.

KIND OF COAL.	Maximum rate of Combustion	
	In pounds of the combustible portion of the coal per hour per sq. foot of grate surface.	Relatively.
Anthracite of Pennsylvania	13.122	1.0000
Welsh Anthracite	13.450	1.0250
Coke from Nanaimo coal	13.600	1.0364
Mount Diablo brown coal	15.027	1.1451
Semi-bituminous coal of Maryland	15.693	1.1959
Nanaimo brown coal	16.124	1.2288
Australian brown coal (second sample)	17.266	1.3158
Bellingham Bay brown coal	17.702	1.3490
Australian brown coal (first sample)	18.133	1.3819
Rocky Mountain brown coal	18.862	1.4374
Coose Bay brown coal	21.761	1.6584
Seattle brown coal	26.396	2.0116

In rapidity of combustion, the brown coals exceed, on an average, tho true coals about one-third.

Potential Vaporization.—By the potential vaporization of the different kinds of coals, is meant the weight of water which these kinds will vaporize in the experimental boiler in a given time with the maximum rate of combustion, and without regard to the quantity of coal consumed or the economy of the vaporization. It is given in the following table, both absolutely and relatively, taking that of the anthracite for unity.

KIND OF COAL.	Potential Vaporization.	
	In pounds of water vaporized per hour from the temperature of of 212 degrees Fahr.	Relatively.
Anthracite of Pennsylvania	2265.495	1.0000
Welsh anthracite	2407.014	1.0624
Semi-bituminous coal of Maryland	2828.471	1.2489
Australian brown coal (first sample)	2819.673	1.2446
Australian brown coal (second sample)	2498.552	1.1029
Rocky Mountain brown coal	2081.780	0.9188
Mount Diablo brown coal	1527.269	0.6741
Coose Bay brown coal	1943.595	0.8579
Seattle brown coal	2449.598	1.0751
Bellingham Bay brown coal	1858.111	0.8202
Nanaimo brown coal	1998.215	0.8276
Coke from Nanaimo coal	1973.766	0.8712

In potential vaporization the brown coals are inferior, on an average, to the true coals about one-seventh.

Economic Vaporization.—By the economic vaporization of the different kinds of coal, is meant the number of pounds of water which one pound of these kinds will vaporize in the experimental boiler. This vaporization varies in boilers of the usual proportion of heating surface to grate-surface with the rate of the combustion, and, as the experimental rates were three in number, namely, the maximum, the medium and the slow, there will be found in the following table the results of all three. Now, as the proportion of ash and clinker in a coal is, in great measure, the result of accidental admixture, and constantly variable, the pound of combustible, or that portion of the coal which remains after deducting the ash and clinker, will be taken to represent the pound of coal; and the number of pounds of water vaporized by it from the temperature of 212 deg. Fahr. under the pressure of 29·92 inches of mercury, will be taken to represent its economic effect.

At the maximum rate of combustion, the economic vaporization by the brown coals was, on an average, 35 per centum less than that by the true coals.

At the medium rate of combustion, the economic vaporization by the brown coals was, on an average, 26 per centum less than that by the true coals.

At the slow rate of combustion, the economic vaporization by the brown coals was, on an average, 24¾ per centum less than that by the true coals.

KIND OF COAL.	Vaporization of water from the temperature of 212 degrees Fahrenheit under the pressure of 29·92 inches of mercury, by one pound of combustible.					
	Maximum combustion.		Medium combustion.		Slow combustion.	
	Pounds of water.	Relatively.	Pounds of water.	Relatively.	Pounds of water.	Relatively.
Anthracite of Pennsylvania	9.504	1.0000	9.472	1.0000	9.413	1.0000
Welsh anthracite	9.851	1.0365	9.651	1.0221	10.673	1.1338
Semi-bituminous coal of Maryland	9.896	1.0412	10.246	1.0817	10.557	1.1215
Australian brown coal (first sample)	8.560	0.9007	9.388	1.0450	9.664	1.0267
Australian brown coal (second sample)	7.966	0.8382	8.509	0.8983	8.930	0.9487
Rocky Mountain brown coal	6.074	0.6390	6.118	0.6460	6.571	0.6794
Mount Diablo brown coal	5.596	0.5888	6.056	0.6392	6.562	0.6971
Coose Bay brown coal	5.094	0.5360	6.385	0.6740	7.180	0.7628
Seattle brown coal	4.916	0.5173	6.328	0.6679	8.006	0.8505
Bellingham Bay brown coal	5.506	0.5793	6.912	0.7297	8.249	0.8763
Nanaimo brown coal	6.788	0.7142	8.432	0.8900	8.949	0.8505
Coke from Nanaimo coal	7.988	0.8405	7.798	0.8233	7.979	0.8477

From the above it appears that the brown coals, relatively to the true coals, gave a considerably higher economic vaporization the slower the rate of combustion. In other words, the economic vaporization was less decreased by increased rapidity of combustion with the true coals than with the brown ones. The former are, therefore, disproportionately better adapted for use when a minimum boiler is employed to produce a given quantity of steam in a given time. For example, with the slow rate of combustion (about 7·109 pounds of combustible consumed per square foot of grate surface per hour), the brown coals were 23½ per centum inferior in economic vaporization to the true coals; with the medium rate of combustion (about 11·045 pounds of combustible consumed per square foot of grate surface per hour), this inferiority became 26 per centum: and with the maximum rate of combustion (about 18·909 pounds of combustible consumed per square foot of grate surface per hour for the brown coals, and 14.088 pounds for the true ones), the inferiority rose to 35 per centum.

In the two former cases the rate of combustion was nearly the same with both the brown and the true

coals; but, in the latter case, it was considerably more with the brown coal than with the true coal, and a portion of the increased inferiority in this case must be credited to the difference in the rate of the maximum combustion of the two kinds of coal.

The economic vaporization given by the coke was, for the slow and medium rates of combustion, about 5½ per centum less than that given by the coal from which it was made; while, for the maximum rate of combustion, the coke gave about 17⅞ per centum greater economic vaporization than the coal from which it was made.

British Association of Gas Managers, June, 1872.

REPORT OF MR. MELLOR, ON THE "EVELEIGH PROCESS"; WITH DISCUSSION.

[Concluded from page 59.]

Mr. Smith (Hyde) wished to know the difference in the specific gravity of the two gases—the gas made from coal, and that made from the oil or tar.

Mr. Anderson said he had the strongest desire imaginable to believe every statement made by Mr. Mellor, and that for two reasons. Mr. Mellor had placed the subject before the meeting in a most candid and gentlemanly manner, and it would be very much to his (Mr. Anderson's) interest if everything stated in the paper was reliable, because he was a manufacturer of gas, and had to purchase large quantities of coal. He was therefore in that mental stage of being open to conviction: but he confessed that he was not yet convinced, and he would state in a few words what occurred to him at the moment as being against the system under consideration. This was the first time, he would venture to say, in the experience of any one present, in which they had heard of a larger quantity of gas being made at a low than a high heat, and he hoped it was a fact, as stated, that the gas so obtained was permanent. It was also the first time they had heard of low heats being able to produce gas as cheaply for labor as high heats, and he was afraid, while giving Mr. Mellor credit for the utmost sincerity in what he stated, that this was a point which he had not thoroughly analyzed and made himself properly conversant with. In the first place, Mr. Mellor stated that, with a retort 9 feet long and 24 by 16 inches in section, he carbonized 4 cwt. of coal in 12 hours. Now, in the ordinary mode of manufacture a retort of that size would take say 3 cwt. per charge, and there would be four or five charges per day, according as five or six hour charges were worked. There, must, therefore, be a considerable increase of labor to obtain the same quantity of gas by the first process. Then as to the fuel account, he could not help thinking the cost must be much greater. His own experience was, that in consuming fuel at a high temperature greater calorific value was obtained from it than at a low temperature. In the next place, there was a second process to go through. Certainly this second process was very beautiful, and appeared to him very perfect. Probably it did require very little labor, but he did not think it would require so little fuel as was supposed, because it really made half as much gas as the first process, although there was only one redistillation apparatus to distil the oil from a bench of 10 or 12 retorts. This was a matter which, perhaps, was open to argument. The quantity of oil or tar obtained was about 30 gallons, and the production of gas from that was at the rate of 150 cubic feet per gallon, therefore there was between 4000 and 5000 feet of gas per ton manufactured from the tar alone. In the first process he believed that the cost of fuel must be more than by the ordinary mode of manufacture, and that in the second it would be from one-third to one-half of that. He was quite prepared to admit that the gas would be of a high illuminating power, because, as was well known, where low heats were employed, though less gas was obtained, it was always of a higher illuminating power than where high heats were used. He was obliged to Mr. Mellor for stating that the works at Barnet were open to the inspection of any members of the association who desired to see them. Whether that visit should be paid before the eminent doctors who were investigating this matter made their report was a question; perhaps if they went there with the report in their hands they would be better prepared to find fault, as it would be their duty to do if they saw it necessary, and thus give those in charge of the process the opportunity of putting pegs in all the holes they made. He wished it to be clearly understood that in anything he had said he had no desire to depreciate the merits of the invention; indeed, he should be happy should it prove to be a success. He only desired to indicate what he conceived were objections in a commercial point of view, and it would be a great satisfaction to hear those objections successfully refuted.

Mr. Price (Llandudno) asked Mr. Mellor to state upon what data he had come to the conclusion that only one-fourth more space would be required for working this process, to make the same quantity of gas, than for the ordinary method of gas manufacture. This was a very important question to those who might have to enlarge their works to adapt them to the new process.

Mr. Hutchinson (Barnsley) said he should be glad if Mr. Mellor would give some particulars as to now he ascertained the heat, the quality of gas produced, and whether there was more coke and more tar than by the usual method of manufacture.

Mr. G. Livesey said he thought perhaps it was due to the association that as this system was now to be tried at the South Metropolitan works, he should state as concisely as possible, the reasons why he had recommended his directors to give it a trial. Before he paid a visit to the Barnet works he was very sceptical on the subject, for he took very much the view Mr. Anderson had taken, that this was the first time anything of the kind had been attempted, and he was doubtful whether it could succeed in this instance. He was not able to make any experiments at Barnet himself, but his friend Mr. Mellor, whom he had known for many years, gave him certain facts and figures in the same way that he had given them on this occasion, and it was from those facts and figures he had come to the conclusion that the thing was worth a trial. There seemed to be no doubt of this, that the gas produced from common coal was of extraordinary purity. The point to be determined was, could it be produced as successfully with regard to cost, as by the ordinary system, taking all the circumstances into consideration. That was well worth ascertaining, and therefore he recommended his directors to give it a trial. One thing which particularly struck him in connection with the invention was the method of distilling the oil. Hitherto in effecting that object the heat had been applied round the oil chamber—at any rate not upon the surface of the oil. The result was to boil the tar and cause it to give off heavy thick carbon vapors which choked up the pipes. By this system the heat played over the surface and evaporated the more volatile constituents, leaving the pitch undisturbed to settle at the bottom. Although Dr. Eveleigh's plan seemed in some respects to be going back from the practice of later years, it was quite possible some of them might be mistaken respecting it. It was said at one time that steamships could never cross the Atlantic, and it struck him while Mr. Clift was speaking, that there was some analogy in the matter. Certain it was, that Mr. Mellor had succeeded in doing that which Mr. Clift found it impossible to do. If only on the ground that by means of this process they could make gas of a very high illuminating power without the use of cannel, the system was well worth a trial. Those companies which were under restrictions as to the quantity of sulphur allowed to be present, and which were bound to a 15 or 16 candle standard, would find an advantage in making a portion of their gas by this system, and thus improve the average quality.

Mr. H. Brothers (London) said he was deeply interested in this matter, having been a cannel gas manufacturer all his life. He thought he might speak confidently when he said that he was able to make as much per ton or per mouthpiece as most people, but he certainly did not make anything like the quantity of gas he desired to make from Scotch cannel. In practice, he found that he was from 10 to 25 per cent. behind the results obtained by chemists and experimentalists; and it struck him that the invention of Dr. Eveleigh might come into his aid in this matter. If cannel coal was distilled at a low temperature and the tar was redistilled in the manner proposed, he thought it quite possible to obtain the results which chemists stated as attending their experiments. He was inclined to believe that the invention would not answer commercially, as applied to common coal, and that in respect of coke, although Mr. Mellor stated that he got a greater quantity per ton, it was inferior in quality to that produced in the ordinary way, because it must contain a great deal of tar. With regard to labor, he agreed with Mr. Clift that the cost must be greater. Here there were two distillations, and not only so, but they were dependent upon human agency, which was very fallible. Every one present was aware that gas managers in London had the misfortune to be under the referees: and to be under the referees meant that they were bound to a minimum as to illuminating power and purity. They also knew from experience that if they used a certain portion of a given material they would produce a certain quantity of gas of a certain illuminating power. But supposing they adopted this process, and some carelessness in the working of the second portion arose, they might obtain an admixture of the two gases which would bring the illuminating power below the minimum, and thus expose them to the liability of a penalty. Then, it occurred to him that man could never make his compounds do as well as those which were provided in nature. In nature cannels were found of a certain quality which it was known by experience would give a certain illuminating power, but if they came to mix these, and to rely upon human agency, they would often be wrong. He thought it would require the greatest attention and care to manufacture—say 16-candle gas—which meant 17 in London—by this process. He was quite convinced, from what he had seen at Barnet, that the wear and tear must be greater than usual, and that the cost of fuel would be higher. Although the heat required was not so high, the time during which the retorts were kept at work per charge was much longer, so that the consumption of fuel must be considerably more; and in addition to that, there was another fire to keep up. Under all the circumstances he was of opinion that at present prices the process would not pay as applied to common coal: but where very rich materials were employed in the product of gas, as in Brazil, which had been referred to, it might answer.

Mr. Warner, of South Shields, remarked that if the invention justified the encomiums of its advocates, and produced 20-candle gas from common coal, the consumers had a good friend in Dr. Eveleigh, because of the saving it would enable them to effect in dispensing with the use of expensive cannels. Mr. Livesey stated that at the South Metropolitan works they were about to erect apparatus in order to give the system a trial. He, Mr. Warner, would be glad to be informed what the cost of such apparatus would be, and whether the Patent Gas Company would charge a royalty for its use in the event of the experiment proving unsuccessful. Probably the company were so well convinced of the correctness of the principles upon which the process was based that they were prepared to erect apparatus and allow the process to be tried for the actual cost, without expecting a profit out of the trial.

Mr. Darwin, of Longton, said he thought that at present prices selling tar must be as good as distilling it, so that as far as his company were concerned he did not see there would be any advantage in adopting the process.

Mr. Parlby, of Aylesbury, asked Mr. Mellor to state whether in carrying out his process there was any difference in the mode or cost of purification.

Mr. Woodall, of London, said there was one point which he felt very anxious to have made a little plainer, and that was as to the relative amount of work that would be done in the space of time mentioned as compared with the ordinary process of manufacture. Mr. Mellor stated that he had no doubt whatever as to the relative quantities of gas produced from the first distillation and the second. He thought he gathered from the paper what was the quantity of gas made from the coal, and as they knew the gross quantity it did not seem that there need be much difficulty in ascertaining the amount made from the second process. But as he understood the figures in the paper, it appeared that altogether with both processes the quantity of gas per mouthpiece with these very large retorts was under 4000 cubic feet. Now, if according to this invention the size of the retorts was increased, and the space required was increased, and additional apparatus was necessary for the second process, while at the same time the quantity of gas produced was less than that obtained under present arrangements, it certainly appeared to him that this must be rather a costly improvement. If the production of gas, too, was prolonged, the cost of fuel and labor must also be increased. On these points Mr. Mellor, who appeared quite disposed to give every information in his power, would probably be good enough to throw a little light.

Mr. Irons, of Gosport, said he should have been pleased to have some details as to the photometer testings. Gas made from two processes combined sometimes chemically and sometimes mechanically, and the illuminating powers varied.

Mr. Hunter, of Rochdale, wished for some further information as to the amount of labor required in working the apparatus. From what he could see a greater amount of skill was required in making gas according to this method than by the ordinary processes. In the practical operation of gas-making very

much depended upon the stokers, and he felt somewhat doubtful of the results if they were to be intrusted with an apparatus which was more complicated and demanded more skilful manipulation than that in general use. He felt bound to take this opportunity of expressing his thanks to Mr. Mellor for the courteous and extremely candid manner in which he had brought this subject before the meeting, and also for his readiness to afford him all the information he sought when he visited the works at Barnet.

Mr. Peebles, of Edinburgh, said he was probably the only person present who heard a paper read some time since by Dr. Macadam, on short time charges and the mixing of different qualities of coals, in which the writer showed, in a tabulated form, that the result of the combination of high quality coal and coal of an inferior description was to produce gas in large quantity and of a very high standard of illumination. By the process now under consideration the coal was distilled at a very low heat during a long period of time, and he, Mr. Peebles, imagined that at the tenth or eleventh hour the gas evolved must be of a very low illuminating power. The question was whether this gas would combine with the gas evolved during the first part of the operation and the gas distilled from the tar, and unitedly form gas of a high quality, and at the same time of good volume. Probably there was a chemical solution of the discrepancies between Mr. Mellor and the other gentlemen who had spoken

Mr. Mellor said he felt very much indebted to the members of the association for the very kind way in which they had received his communication, and the courtesy with which they had stated their objections and raised inquiries. He need hardly say that all which he had stated he thoroughly believed. He would proceed as briefly as he could to reply to the question put to him. The first remark made and the first inquiry proposed was by Mr. Clift. That gentleman said he had been using iron retorts for a long time: that he got from 8000 to 9000 cubic feet of gas from them; that he worked them at certain heats, and that he found tar would not make gas so as to be profitable. Now, if iron retorts were worked at a very low temperature indeed, not more than half the quantity of permanent gas would be generated, and there would be a large quantity of oil; whereas, if worked at a high heat, they absolutely destroyed the gas bearing properties of the oil, and it was of no use attempting to make anything of it. In working at a high heat in iron retorts a carbonaceous deposit was formed on the inside of the retorts, and they generated that which the referees made so much bother about, the troublesome compound bisulphide of carbon. This impurity had been, so to speak, very much thrust down the throats of gas managers lately, and that, too in a very disagreeable form: but, after all, there was very much in the complaints made about it, and he was convinced that its presence was owing to the very high heats employed. Mr. Clift stated that he obtained 1s. 3d. per gallon for his tar, but he, Mr. Mellor, never before heard of tar selling at that price.

Mr. Clift—No; I said I obtained 1s. 3d. per gallon for the light oil distilled from the tar: that is, that which you take from the tar to manufacture your gas with.

Mr. Mellor—The benzole you mean?

Mr. Clift—The naphtha.

Mr. Mellor—I thought you said you made 30 gallons of tar per ton of coal, and got 1s. 3d. per gallon for it.

Mr. Clift: I wish I could. What I said was that the oil you take off to convert into gas is worth 1s. to 1s. 3d per gallon in the market at the present time.

Mr. Mellor: Allow me to ask how many gallons per ton, and then I can get at the result.

Mr. Spice (London) said 2,500 gallons of tar would produce 70 gallons of the oil which Mr. Clift stated to be worth 1s. 3d. per gallon.

Mr. Mellor, proceeding with his reply, said Mr. Clift called the Eveleigh process two operations, but it was in reality only one, for the whole was carried on in the same place, at the same time, and by the same men. The first process was to make from 7,500 to 8,000 cubic feet of gas per ton from the coal, and as he took it, it did not matter whether they turned the oil obtained into a still and redistilled it at the same time, or whether they left it alone: the quantity of gas obtained in the aggregate was what they must base their calculations upon. Mr. Clift stated that he had been able to get 8,000 or 9,000 feet of 14 or 15-candle gas per ton from his retorts, worked in the ordinary way, whereas he (Mr. Mellor) had obtained 7,500 or 8,000 feet of 25-candle gas per ton, by adopting a proper heat, from the first distillation process. He then had from 30 to 40 gallons of oil, which he converted into gas—permanent gas—making, say, an aggregate of 11,000 feet per ton, to be within the mark. He had never been able to get more than 1½d. or 2d. per gallon for tar, even with benzole at 2s. 6d. per gallon in the market, and it was not even worth that now. With regard to fuel, that seemed to be a very important question in the minds of some of the friends present. They all knew that if they burned their fuel as they ought to burn it so as to obtain the largest amount of calorific value, it did not matter whether they burned it at a high or at a low heat: there was a certain amount of heat to be obtained from the fuel, if proper attention was given to its economical consumption. Now in the heats employed in the Eveleigh process, from 1,200° to 1,300° Fahr., they must exhaust from the fuel in the same time very much less of its calorific property, so that as a matter of fact the fuel would last longer. They did not require so much heat to maintain a cherry red as to maintain a white heat; and when it was remembered that they put from four to five cwt. of coal in each retort to obtain 10,500 feet of gas per ton, by these two processes, it would be seen that they did not in reality require more fuel. His experience at Barnet was that during five months the fuel had not averaged more than 25 per cent., although working at great disadvantage, sometimes having 5 retorts going, sometimes ten, and sometimes 20, and the conclusion he had arrived at was that with so low a temperature in the first process they saved as much fuel as was required in the second process. Mr. Allen asked whether there was any choking of the pipes. To this he (Mr. Mellor) replied that in this process there was absolutely no choking at all of the pipes. During the time that Dr. Odling and Mr. Keates were examining the works, the eduction-pipes were untouched for 14 days, and when they were afterwards opened in his presence they were as clean as his hand. Mr. Stephenson, speaking of the invention of Dr. Eveleigh, very properly said that it would be a valuable auxiliary to gas companies, enabling them to make 15 into 20-candle gas; and what he (Mr. Mellor) would ask the members of the association to consider with regard to illuminating power was this, that in the present day the tendency of legislation was to raise the standard in this respect, and gas managers must be prepared to meet it. Now, as they could not very well make from any description of coal which came to London, except it might be the Silkstone, gas of 16-candle illuminating power without the admixture of cannel, this process came to their help in making gas of that description, avoiding the necessity to use cannel at all; and he recommended it to their attention on that account. With regard to the permanency of the gas, that was a point upon which he never had the slightest doubt from first to last, though he had thought it possible that like all other gases it might, if kept a long time, lose a little of its illuminating power. There was one thing upon which he had been sceptical—viz., whether the two gases would mix; and it appeared to him that this would be one of the greatest difficulties. To settle the question, he put the two gases in a gasholder, and introduced one pipe at the top and another at the water level of the holder. On burning from each, there was not a quarter of a candle difference in the illuminating power of the two gases, neither could he find any difference in the specific gravities. This satisfied his mind that there had been a thorough commingling of the gases. With regard to permanency, a test was applied at East Barnet, for which he was little prepared. At the time Dr. Odling and Mr Keates commenced their experiments the whole of the gasholders were full, and it was determined to shut off the inlet and outlet pipes, and leave them in that condition till the experiments were finished. The gas was kept in the holders for 15 days, and on being tested was found to have lost only 1½ candles of illuminating power. Further than that, the gas was tested at a distance of 1,100 yards from the works; he selected a house at that distance so as to conform to the rules of the referees; and for four months there was no deposit appreciable at the syphon on the main. If the gas had not been permanent there must have been a deposit, but, in fact, there was none; *ergo* it was permanent. Upon that point he held a very strong conviction, and, therefore, he boldly stated in his paper "that the gas when made is quite permanent, and produces no deposit in the mains beyond that of gas made in the ordinary manner." Mr. Anderson asked the quantity of pitch obtained, but he did not ask what was the quality of the pitch. The quantity varied from 70 lbs. to 80 lbs. per ton of coal, and the sample on the table would be seen, upon examination, to be of a very soft, rich-looking character, and he thought it would be found to contain, except the benzole and the aniline, most of the other valuable products of that article. He could not say much more upon that subject, but perhaps Mr. Goddard, who knew more about it than any one in the room, could supply further information. He believed if carefully analyzed it would, as he had said, be found that, with the exception of the lighter hydrocarbons, this pitch contained most of the valuable properties of tar—the anthracene and other matters referred to by the president in his address. If that were so, it proved that the 3,000 feet of gas—or 100 feet to the gallon taken out of it—was obtained to their hands for nothing. With regard to the remark made by Mr. Anderson as to going down to see the works, what he said was this—that ever since he had been in a position to show the works, he had never refused, to any engineer who had asked for it, the privilege of seeing them, and that he would be happy to see not only Mr. Anderson there, but every one else in the room. But he had been asked before he was ready to allow people to see the process. Had he consented, he would have had nothing to show them, and it would only have been to occupy the time of the applicants and his own to no purpose. In a new thing like this, many alterations had to be made in order to bring the operations into practical working, but for the last two months the works had been open to the inspection of any one, and if Mr. Anderson would pay them a visit he would be happy to devote a day to the examination of the process with him. In retorts of the size employed—viz., 24 by 16 and 9 feet long—he could put about 9 feet of coal, which was nearly 4¾ cwt. If he attempted to get all the gas out of that in six hours, he should fail in doing it; but by burning it for twelve hours, he got, with the oil distillation, nearly as much gas on the same space as was obtained in the ordinary method of manufacture, and therefore he thought he was quite within the mark when he said that one-fourth more space would be required in the new process to make the same quantity of gas in the same time. In reply to the question as to the specific gravity of the gas, he stated that he had not tried it by itself in such a manner as to be able to give any reliable information, but it would be ascertained much more satisfactorily than he could it by the gentlemen now engaged on the investigation. Mr. Price mentioned something about the heavy charges, and said he could take off the gas in four hours. If a higher quality of coal or cannel was used, the time would be reduced to five or six hours. The higher the quality of the coal, the less time would be required to take the gas off: that was, he believed, the result of general experience. Mr. Jackson asked how he ascertained the heats. They were ascertained by Bailey's calorimeter. The quantity of gas was ascertained by the station-meter, and the quality by the referees test. Mr. Brothers would forgive him for saying that he quite disagreed with one observation made by him. He expressed his opinion that the coke made at a low heat was not so good as when a high heat was employed. He—Mr. Mellor—maintained that it was better. Coke, when made for foundry purposes, in coke ovens, was subjected to a low heat, which was gradually increased to a high heat, and exposed from 24 to 30 hours at a time. If drawn off at 5 or 6 hours, it was not so good as when left for 12 hours, and the longer it was burned, within reasonable limits, the better. With regard to the question of the cost of labor. The only labor required in the redistillation was to pump the oil up into the cistern, from which it ran into the stills, and to keep the fire going. The charcoal employed in the charcoal cylinder did not seem to depreciate in quantity, but it did in quality, and in time required to be changed—say, about once in two or three weeks. Every three or four days it was necessary to take off the cover and loosen the charcoal. With these exceptions, there was little or nothing to do in the way of labor; and he thought he was right in stating in his paper that one man could easily attend to six of these stills without the slightest trouble whatever. In reference to the temperature at which he had been working, he had been chiefly guided by the amount of sulphur in the coal employed, so as to bring the quantity in the gas down to 6 grains per 100 feet, according to the contract with the Barnet Company. The lower the temperature, within reasonable bounds, the less sulphur there was in the gas; and as the temperature was increased 100° by 100°, so he got a grain or a grain and a half additional sulphur per 100 feet. With that exception, he saw no difficulty whatever with regard to dependence upon human or mechanical agency. He believed that any man with ordinary intelligence could attend to the process; and he was justified in saying so by the fact that, with the exception of the foreman, who was changed last year, the same men were employed now at the Barnet as were at work there before the new process was introduced. He had made all these statements in good faith, and must leave them with the members of the association to think over. If they required further information, he would be happy to furnish it on the spot at Barnet. One member asked whether the gas obtained was really of 20 candle illuminating power. He could only say in reply that the daily testings had conclusively shown it to be so, with one or two exceptions last month, when it went down to 19·59 candles. As to purification, he might state that no claim was made to interfere with this part of the manufacture, which could be carried on as in the ordinary way at gas-works. As to the quantity of gas per monthpiece, he found that five retorts with twelve-hour charges gave 16,000 feet. The oil process brought this up to 22,500. Dividing that by 5 gave 4,500 cubic feet per monthpiece. He could not give the make per man at the moment, he could only say that no more labor was required per ton of coal used than usual, except for the distillation process, and the quantity of gas obtained from that covered the extra labor employed. Mr. Irons asked a question

in reference to variation in illuminating power, in reply to which he would state that during the last two months the gas at Barnet had not varied more than 1½ candles between the highest and lowest point, and that the two gases did regularly mix he had already remarked. He believed he had answered what Mr. Peebles had said about short charges. He did not think it was good policy to mix the coals in the distillation for gas. If they had a coal—say a cannel—which passed away its gas in three or four hours at a moderate temperature, and that was mixed in the same retort with a lower class of coal, which took five or six hours, there was no economy in this; it was better to distil separately and mix afterwards. The only other question he had to answer was that put by Mr. Warner, and he was sure that no one would blame him for saying it was hardly likely that Dr. Eveleigh or those who worked his patent would allow it to be used for nothing. If the system was what he claimed for it, it must be a very good thing, and by good he meant commercially good—there must be a saving in it, and Dr. Eveleigh, and those associated with him, would expect to reap the advantage of the invention. The agreement made with the two or three companies who had determined to try it was this—in one case they were to pay so much per 1,000 feet; in another, as suggested by Mr. Stephenson, so much per retort. He did not think the Patent Gas Company would wish for anything like a heavy royalty in the matter. He had always advised them to take a low rather than a high royalty, and he had no doubt whatever satisfactory arrangements would, in all cases, be effected. With regard to the cost of the apparatus, the company were now putting up for the South Metropolitan and Crystal Palace District Gas Companies two sets at cost price. In the one case the cost was not to exceed, including many things that would do very well for more retorts, £600 for ten retorts, and in the other, £1,000 for twenty retorts. As he stated in his paper, he believed the additional cost of apparatus, including the oil stills, would amount to £25 per retort in the first instance. In conclusion, he begged to thank the members for the kind manner in which they had listened to his observations.

The President said, as the representative of the members of the association on that occasion, he thought he might fairly thank Mr. Mellor for the candid manner in which he had entered into the description of the new process of gas manufacture. Mr. Mellor, coming forward as he did to meet a body of gas managers, no doubt expected that the principles and details of the invention would be critically viewed, and he was sure that he would not feel aggrieved by the spirit in which these had been commented upon. It behooved those who occupied the position held by members of the association not to be biased against any professed new discovery, but to look at it carefully and judge of its merits on scientific and commercial grounds. The gist of Dr. Eveleigh's patent process appeared to be that he volatilized more carbon than in the ordinary mode of gas-making, and he claimed that by mixing the two gases so made he gained a considerable increase of illuminating power. But after having heard all that Mr. Mellor had to say on the subject, he—the president—must express his opinion that they had not yet got what they required to determine the point—viz., what was the true commercial value of the process. Mr. Mellor, he was sure, had given them every information as far as he was able, but no doubt he was restricted in some respects, and had acted wisely in not going into this part of the subject. His—the president's—only fear was that the two gentlemen referred to, who were chemists, would at the close of their investigation only report upon the matter chemically, and that the desired knowledge of commercial results would not be acquired from their researches. With reference to the permanence of the gas made by Dr. Eveleigh's process, Mr. Mellor had tested it as far as he could, but, as a practical gas manager, he—the president—would much have preferred a statement that Mr. Mellor had ascertained by the station-meter for a given time that the make of gas been so much, and that during that period the consumers meters had registered so much, and the public lamps had consumed so much. By deducting the one from the other he would have been much better able to judge of the permanency of the gas than by the experiments which had been made. In company with several gentlemen, he—the president had been to Barnet to see the process in operation, and was received by Mr. Mellor with great kindness, and supplied with all the information in his power. The process seemed very plain, and the result satisfactory: but after all, as commercial men, they must look at the balance-sheet, and unless good returns in that direction could be exhibited, it was of little importance, comparatively, how beautiful or ingenious the arrangement might be. At present they had not obtained all the data for demonstrating that matter. It was evident, however, that 20-candle gas could be produced from common coal, and this was an important step in the right direction; for even if the thing went no farther, he agreed with Mr. Stephenson in thinking the invention might be satisfactorily utilized in raising the standard of ordinary common gas as required by Act of Parliament.

Let Us Have Air.

THE MISERIES OF THE FERRY BOAT AND CAR TRAVELLER—WHY CANNOT WE HAVE OUTSIDE SEATS?

[From *Appleton's Journal.*]

New York projects into a noble bay, and is bordered on each side by a splendid river. Upon these waters innumerable ferry-boats ceaselessly ply, and hence the opportunity to obtain a breath of cool air from the sea would seem to be within reach of every citizen, and yet it is not, unless partaken under many discomforts. Not one of our ferry-boats is provided with outside seats. One must either sit in the close cabin, or stand packed in the air-seeking crowd without, envying the few fortunate ones who have obtained places at the guards. All the while the upper deck of the boat is unused. Here is abundant space for seats, where the elevation would always insure cool air. There should be awnings and easy-chairs on the upper decks of all our ferry-boats—at least on those of the longer ferries. Here women and children could find health and enjoyment in the day-time, and at evening fatigued citizens would gather in great numbers to refresh themselves in the invigorating air from the sea. There is not a fashionable watering place in the land that could give its habitues more real out-of-door enjoyment than might thus be provided for the poorest citizens, if our ferry companies had only the wit and the public spirit to undertake it.

But not only are our ferry companies insensible to the needs and wants of the public; car superintendents and omnibus managers are equally obtuse as to the comforts they might afford their patrons, and all to their own great profit. Why should not our cars and omnibuses have outside seats and protecting awnings? In such case an up-town or down-town ride would be one of pleasure, instead of the horrible discomfort it now is. The cars would need no greater draught force, if only passengers enough for the seats were taken. The omnibuses would require more horses; and, if it is objected that four horses to each omnibus would crowd our already overthronged thoroughfares too much, the plan of three horses abreast could be adopted. But these matters of detail would admit of easy adjustment. What we urge is, that ferry, car, and omnibus travel would be vastly enhanced in comfort, might even be rendered highly attractive, if those concerned would simply comprehend that in summer time people are anxious to get in the air—that close cabins, shut-up cars, closed-in omnibuses, are out of all reason for at least six months of the year.

Report Upon the Elmer Process of Gas Manufacture.

BY PROF. HENRY WURTZ.

To the New York Gas Light and Heat Company.

Gentlemen: As commissioned by you, I have occupied myself more or less for several months past, in tests of the method used by you in the manufacture of gas for lighting the Grand Central Hotel, in New York city. In this work I have met with most of the obstacles that are incident to experimental operations. To ennmerate all these would take too much space. Some arose from radical defects in construction, which, now that they have been indicated to you by practice, will be readily rectified and avoided hereafter. These led to stoppages of flues, leaking of retorts, collapsing of holders, etc. Strikes, on the part of the workmen, and necessito of employing unskilled hands also occurred. A main difficulty in getting continuous results arose necessarily from the limited consumption during the summer season, which made it impossible to dispose of or get rid of the gas even from one bench, when kept at work continuously. All gas managers will at once recognize, moreover, the impossibility of keeping up good and regular heats in an isolated bench of retorts. Numerous other minor difficulties occurred which will be avoided when working on a larger scale and with thorough system. Perseverance and persistence, nevertheless, which overcome all things, have led to the accumulation of a sufficient number of results to satisfy the most exacting, as to the merits of your process.

A number of experiments upon your gas were made from time to time during the last spring. I found by repeated and careful photometric tests that the gas from the main supplying the hotel ranged usually from 20 to 24 candles, rarely lower than the former figure. To give an idea of the average make of gas during this time, I shall give the record of the station meter during the first half of May last.

Date.	Meter.	Charges in pounds.	Make.	Make per lb.
May 2.....	464,880			
" 3.....	476,860	2200	11,980	5.45
" 4.....	488,610	2200	11,750	5.35
" 5.....	500,900	2300	12,290	5.34
" 6.....	511,310	2100	10,410	4.73
" 7.....	521,080	2500	9,770	3.91
" 8.....	531,680	2150	10,600	4.91
" 9.....	545,660	2200	13,980	6.35
" 10.....	557,460	1800	11,800	6.56
" 11.....	565,370	1200	7,910	6.60
" 12.....	527,740	2300	12,370	5.38
" 13.....	584,660	1200	6,920	5.77
" 14.....	597,180	2300	12,520	5.44
" 15.....	607,630		10,450	
Average make per lb. (rejecting May 7)....				5.63

From my numerous tests during this time, I can rate this gas at an average of 22 candles.*

As at this time, however, a mixture was being used containing a little Ince-Hall cannel (though of low quality), it was thought best by me to defer reporting results until a sufficient stock could be laid in of some well-known standard American gas-coal, which would furnish results comparable with those obtained in our ordinary gas works.

For reasons unnecessary to explain, it was not until July that a stock was secured of Youghiogheny coal, (from "Moore's mine," "Coal Hollow Coal Co."). A lot of about 25 tons of this was sampled for analysis by picking out from all parts of the heap a peck of small fragments. This was all crushed fine and mixed well. The result was (in the open crucible) 33.66 per cent- of volatile matter, corresponding to a good quality of this gas coal.

I observe that Prof. Wormley, in the Geological Survey of Ohio, page 231, gives for the volatile matter in Youghiogheny coal, as used at the gas works in Columbus, Ohio, 28.9 per cent. This result was probably obtained in the ordinary way, in a closed crucible, a method which I have always found to give a lower figure than the practical working in the gas retort.

Before making the following tests, the apparatus used was tested and verified throughout; namely the meter, clock, photometer bar, balance and weights. The balance used was an analytical balance, sensitive easily to five milligrammes, or say to one-twentieth of a grain. The weights were of aluminum foil, made by myself. The level of the water in the station meter was verified constantly. In order to avoid varying pressures, the gas was always passed, before testing, into a small holder arranged for the purpose, containing five cubic feet, which was furnished with a pressure gauge, and could be counterbalanced by weights, so as to obtain any required pressure, and to render this and the flow uniform.

The density of the gas was determined by means of a little apparatus on the effusion principle (which was suggested by Bunsen), the relative times being mark-

*It will be remembered (see AM. GAS-LIGHT JOUR., May 16, 1872, pp. 156-7) that in the preceeding month, April, Mr. Goodwin obtained by this process, from Westmoreland coal alone, selected by himself in Philadelphia, 5·48 and 6·63 (in the mean, 6·05) feet per lb. of gas of 21·66 candle power, results remarkably close to the above.

ed by a stop watch, of the effusion through a minute hole in a sheet of platinum of equal volumes of air and of the gas under examination, both kept under the same pressure of water. The density is the ratio of the square of the time of effusion of the gas to the square of the time of effusion of the air. This method is more accurate and infinitely easier and more rapid than any other.

The *burner* selected to be used in all these tests, after spending a weeks time in careful experiments on a large number of burners of various patterns, including 12 candle, 18 candle, and 20 candle Argands, fish-tails and others, was a porcelain tipped Bronner batwing, No. 5, which was found to give the most uniform results at varying flows and pressures, both with your gas, and that of the Manhattan Company (with which the photometric room was also supplied, at my suggestion).

[As cuts and specifications representing the construction of the apparatus used in obtaining these results appear on another page of this issue of the Journal, I shall not stop to make any remarks on this head.]

It seems proper for me to introduce the following statements of numerical results arrived at, by saying that they comprise but a portion of the tests made, namely those in which, on careful examination, no possible flaw could be detected. It will readily be understood that as it was impossible for me to be present constantly, and watch night and day; having to trust, for the recording of figures, in numerous cases, to the operatives, it was several times found that palpable mistakes had occurred, introducing discrepancies. All such cases were thrown ovt altogether. The figures given below are therefore in a certain sense *selected*, though by no means to be regarded as picked samples, favoring the process; but only as those which admit of no shadow of doubt.

The first altogether satisfactory test with the Youghiogheny coal was obtained early in July, being the one reported in the GAS-LIGHT JOURNAL of August 2, 1872, page 44. The complete records of this test were not preserved, but the general result from 1600 lbs. of coal charged during 24 hours into two retorts was 5.7 feet of gas per lb. of density 0.525 and 20 candle power.

TEST OF JULY 15 AND 16.

July 15.—Two iron retorts were charged, each with 400 lbs. of coal, one at 9 A.M. the other at 9.30. The station meter was noted at irregular intervals, for five hours. Steam was turned on at 9.55. About 7 P.M. 800 lbs. more was charged into the two retorts.

Time.	Meter.	Make, for equal intervals of 30 min.
9.00	824,595	
9.32	,755	180 feet
10.00	5,056	315 "
10.25	,255	246 "
10.55	,470	205 "
11.55	,825	182 "
12.18	,945	157 "
12.35	7,035	159 "
12.56	,142	153 "
1.12	,242	158 "
1.41	,380	159 "
July 16th 9.08	831,635	

Total gas, from 1600 lbs=7,055 feet, or 4.4 feet per lb.(=9856 feet per ton.)

This is not a large yield, and indicated something wrong in the heats, doubtless during the night. The density of this gas, however, was found to be very high=0·547, and the following observations of candle power were obtained, the weighed candle having been burned 50 minutes, and the ten observations made during that time at intervals.*

Rate of candle 124 grains per hour.

Disc.	Meter.	
24	83.5	
24	84	
24	84	
23	83	
21	81.5	
22	82.5	
22	82.5	
27	84.5	
26	84.5	
26	84	
Ave=23.9	83.4	=5,004 ft. per hour.

This, reduced, gives 24·7 candle-power: and the *sperm equivalent* here obtained, per long ton=807·6

TEST FROM JULY 18 TO 21, INCLUSIVE.

The gas tested wae made during four days, no night charges being put in, in consequence of the limited consumption at the hotel. Eight charges of 300 lbs. =2,400 lbs. in all, have 13,660 feet=5·69 feet per lb. This gas gave an average of 19 candles, tested at intervals. This is equivalent 831·7 lbs. of sperm, almost the same as the last. The density of this gas does not seem to have been taken.

TEST OF JULY 29TH.

During this day, 1000 lbs. of coal were charged, in two charges of 200 lbs., at 8.30 and 9.30 A.M., and two of 300 lbs. at 7 and 7.30 P.M. The gas, collected in an empty holder, was cut off therefrom at 12, midnight. The volume was 5,200 feet=5·2 per lb.—Candle power=20·77. Sperm equivalent=82·95. Density=0·5184.

TEST OF JULY 31ST.

In this test (as well as the next one, of Aug. 2d) in order to prove the merits of the principle, pure and simple, without complication with the water gas, *no steam* was introduced. Eleven hundred lbs. of coal was charged, in two charges of 250 lbs. each, at 8.30 and 9 A.M., and two of 300 lbs. each, at 6.50 and 7.20 P.M. The gas was cut off from the volume to be tested at 12.05 A.M., Aug. 1st. The total volume (up to this time) was 4·25 per lb. The next morning the total gas from the 1,100 lbs., by the station meter, was but 4·65. This shows poor heats.

Tests made Aug. 1st of the 4·25 feet. Density=0·532. Candle power=22·10—15 observations during 36 minutes. Sperm consumption=121·15 grains per hour. Flow=4·932—reduced candle power=22·62. Sperm equiv.=80·3. Another sample (taken in the small holder) gave 20·2 candles; but it was afterwards found, by analysis to have two per cent. of air, introduced accidentally. A third sample was collected and allowed to stand 24 hours, till next day. This gave 22·73 reduced candle power for 20 observations, during 34 minutes. Rate of candle=119·7. Flow=4·904.

TEST OF AUGUST 2D.

In this test (and the next one, of August 4th) the plan was adopted of collecting (in an empty tank) the gas from the *day charges only*, letting the night charges make into the other tank. Several sources of doubt and embarrassment were thus avoided. It was observed, for example, that the night make (during my own necessary absence) usually fell off greatly both in quantity and quality, for reasons which gas men will not need explained. Mr. Goodwin, as may be remembered, who remained near the bench during the whole time of his experiments, had precisely the contrary experience. 500 lbs. coal charged in all, 250 at 8.15 and 250 at 8.40 A.M. Gas cut off at 7 P.M. Total gas, equal to 2,850 feet, equal to 5.7 feet per lb. Density, equal to 0.519. Candles burned 26 min., at rate of 118.82 grains per hour. Fifteen observations, average flow 4.946. Observed candle power, equal to 20.03. Reduced 20.05. Sperm equivalent, equal to 816.3.

Some parallel observations were made (August 3) on the gas from the mains of the Manhattan Company. After letting it run to waste for half an hour, the small holder was filled. Density, equal to 0.41. Candle burned 30 minutes at 120 grains per hour. Ten observations, average flow, equal to 4.962. Observed candle power 17.15. Reduced equal to 17.3.

TEST OF AUGUST 4TH.

500 lbs. charged, 250 at 9 A.M. and 250 at 10.25 A.M. Gas cut off at 8.20 P.M. Total Volume, equal to 3,270 feet, equal to 6.54 per lb. Density, equal to 0.504. Candle burned 18 minutes, at rate of 125 grs. per hour. Reduced candle power, equal to 16.04.

Tabulation of Total Results.

Make per pound.	Candles.	Sperm Equivalents.	Density	Percentage of gas.
4.50	21.66			
5.66	21.66			
5.48	21.66			
6.63	21.66			
5.63	22.			
5.50	20.	802.6	0.525	22.10
4.40	23.9	807.6	0.547	18.40
5.69	19.0			
5.20	20.77		0.518	20.63
4.25	22.70	830.	0.532	19.43
5.70	20.05	816.30	0.519	22.50
6.74	16.04		0.504	

Westmoreland coal according to Sabbaton. Make per pound, 4·24; candle power, 16·62; Sperm equivalent, 541·2; density, 0.420; Percentage of gas, 13·64.

While fully admitting the propriety of the caution which is customary and laudable among practical men with regard to novel processes, I shall nevertheless conclude this report by asserting the principle that, in chemical matters, what has once been done may again be done, and may be accomplished continuously and surely, when practice has taught precision and certainty in manipulation; and that hence we should be fully justified in adopting the *best* of the above figures, instead of their average, as representing what will yet be attained to in actual working. This view is greatly strengthened by a consideration of the numerous drawbacks and disadvantages under which the above figures were arrived at.

All of which is respectfully submitted-

HENRY WURTZ.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—ED.

New Gas Works in San Francisco.

SAN FRANCISCO, August 14th, 1872.

Mr. Editor: It is not often I see in your Journal any correspondence from this place. As there is news of interest to gas men at this distant point, these few lines will post you.

More than two years ago the "City Gas Company" began the erection of an opposition gas works in this city. The building of them was given to B. P. Brunner, late Engineer of the Charleston, S. C., gas works. The latter part of last April they commenced to supply gas to our citizens, and so far they have proved a formidable opposition to the old Company.

Although I have visited most of the principal gas works in the United States, I will say that a more complete, better built, or more finely finished works does not exist in this country; and to Mr. Brunner, the Engineer who designed and built them, and to the stockholders who had the nerve to invest more than a million dollars in their construction, much credit is due.

The works front on the bay, and have a fine wharf, with steam hoist for the cheap and rapid discharge of coal from the ships. The coal, in cars, is run along the top of the coal house, when it is dumped through

[*For continuation see page 82.*]

* In all the photometric work, special precautions were taken to eliminate, as far as practicable, the error from irregularity of sperm consumption, by extending the usual time of observation very greatly, to half an hour, often to an hour. That is, the loss of weight of the candle was ascertained during the whole period, though the observations of the disc were not taken *every* minute, but (in connection of course with the flow in a minute by the clock) at intervals during this period.

This plan, while actually less troublesome and exacting than the ordinary mode of proceeding, is much more accurate, and in cases where saving of time is secondary, will commend itself to photometrists.

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☞ All communications to be addressed to "THE EDITOR, No. 42 Pine Street, Room 18, New York.

FRIDAY, SEPTEMBER 2, 1872.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted. the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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TO OUR SUBSCRIBERS AND PATRONS.

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THE OXYGEN LIGHT AT BUFFALO.

From three several sources, we have had sent us copies of accounts of the introduction of oxygen gas into the streets of the city of Buffalo, and from these and other sources come requests that we should put on record, for the behoof of the readers of the Journal, our views, opinions, beliefs, speculations, and so on, regarding the past, present, and future of modes of illumination of this class. To which we must say :—Gentlemen, please have a little patience with us. So far as there is, or may be, novelty, in these methods, few are less specially enlightened than we. From the newspaper press and from hearsay, we learn that oxygen has again been introduced into our New York streets, but other imperative demands upon our time have permitted no personal investigation as yet. For the present therefore, all that can be done is to convey the facts as conveyed to us from Buffalo.

The public prints of that city state that the "Buffalo Oxygen and Hydrogen Gas Company" received permission Dec. 18th, 1871, to lay their pipes through the streets, etc., of that city. Two holders 60 by 22, have been erected by them, one for oxygen, the other for hydrogen, the latter, as we understand the account, to be charged with vapor of petroleum-naphtha. Two sets of mains carry these two gases through the streets.

Retort houses, etc., one 100 by 80 feet, have been built, containing two sets, of twenty retorts each, for the two gases. The specifications transmitted to us of the details of construction are not distinct enough to be of service. The oxygen is made by the well-known Tessie du Motay method, as practised also in this city, by alternately oxidating by air and by reducing superheated steam, manganate of soda. The method of making hydrogen is not altogether clear. If we understand it aright, water-gas, or a mixture of hydrogen and carbonic oxide is first made, n the usual way, from steam and incandescent carbon, and it is asserted that by bringing this then into contact with heated hydrate of lime, carbonate of lime and pure hydrogen is the result. We desire proof of this. If authentic, the reaction is simple enough

$$CaO,HO + CO = CaO,CO^2 + H.$$

The hydrogen, as aforesaid, is to be used as the vehicle for naphtha vapors, to be burned with the oxygen after the manner of the old Bude light, producing what the reporter describes as "a most wonderful degree of effulgence." We understand, from an official of the New York Oxygen Company, from whom we have had the pleasure of a call, that the oxygen is *here* burned with both the naphtha gas of the Mutual Co., and the ordinary coal gas of the Manhattan Co., with about equal success. The 'Tifft House" in Buffalo it appears, is now lighted by oxygen, whether burned with naphtha and hydrogen or with coal-gas does not appear.

The New York official above spoken of, stated to us that the promoters of the new oxygen manufacture expect to find demands for the gas for metallurgical and other purposes, which will not be second in importance to that for light. Finally, we wish to say, as we have said on a previous occasion, that these columns are open, not only cheerfully, but as a matter of course, to all *authentic* information on this, as well as other subjects, relating to the manufacture or utilization of oxygen and of gaseous products of every nature; and whatever information shall come to us upon such subjects possessing novelty and utility, either from our own observation, or from other sources on which we can rely, will be presented promptly and fully, "nothing extenuating, nor setting down aught in malice."

THE EVELEIGH REPORT, OF MR. MELLOR.

In this issue this document is concluded, and our readers will find Mr. Mellor's rejoinder to the various practical objections brought forward by the eminent gas experts among his audience. This rejoinder displays much ability, and seems to cover most of the ground.

His tilt with Mr. Clift is amusing, as exposing the absurdity and sophistry of the remarks made by the latter gentleman (as quoted in our last issue). It would seem impossible that Mr. Clift should, in his own mind, have confounded together *coal-tar*, properly so-called (which is a mixture of products formed largely by the *condensation by high heats* of lighter and more volatile vapors and gases into heavier, denser, and less volatile, substances of more complex molecular constitution) and *coal-oils*, formed by the distillation of coal at comparatively low temperatures. Of the former class of products naphthaline and anthracene may be taken as representatives, and of the latter, the paraffines and other hydrocarbons of the marsh gas series.

It is familiarly known that the former class of substances, formed by condensation, with elimination of hydrogen or marsh gas usually, when once constituted resist the action of further heat with great pertinacity, or, if yielding slowly, merely give still more highly condensed hydrocarbons, like gas-carbon for example, with further elimination of hydrogen. For instance, Berthelot has shown that gaseous acetylene, formed at high temperatures, by further exposure to high heats, undergoes a condensation of three molecules into one, forming the liquid benzole :

$$C^4H^2 + C^4H^2 + C^4H^2 = C^{12}H^6$$

and on further exposure of benzole vapor to high heats (as for example to the electric spark) this undergoes a further condensation to oily and tarry products, with elimination of hydrogen.

The paraffines and paraffine oils, on the other hand, are readily convertible, by a regulated heat, into permanent gases; and it is clearly the true direction in which to seek for the realization of a greater amount of candle power from gas coals, to endeavor to avoid as much as possible the formation, in the first instance, or at any stage of the process, of the highly stable condensed products that make up the bulk of ordinary coal-tar. It seems obvious that it has been this kind of consideration of the subject, whether founded on study, or, more probably, on practical experimentation, that has led Dr. Eveleigh in England, and Dr. Elmer in this country, to the devising of modes of operation and forms of apparatus, calculated to render available these now well-recognized principles, which have been familiar, at least to the advanced school of gas-chemists, now for many years.

In passing, we take the opportunity to call attention to the fact, that in the present issue the results that have been obtained by the Editor, in his recent examination of the workings of the Elmer process, are summed up. No comments will be made on this occasion, but the facts and figures will be left to speak for themselves. For want of room, much had to be omitted, among which is included all the analytical results upon the gas; as it was thought that practical men would be more immediately inter-

ested in the practical questions of quantity and quality, than in that of chemical composition. Occasions will doubtless occur hereafter to supplement the report, by supplying the portions that have been crowded out.

THE GAS LIGHT COMPANY OF AMERICA.

In view of recent publications in the *Journal*, we are requested to publish the following extracts from an opinion lately given by Messrs. Keller & Blake, of this city, on the matters therein presented. The Gale and Rand patents are now owned by the Gas Light Company of America, C. K. Garrison, Es., President, and E. M. McGinnis, Esq., Secretary and Treasurer.

"We have examined the five patents submitted to us, and the following is our opinion.

"The re-issued patent, No. 3,873, granted to Nichols, Rand and Brown, assignees of L. D. Gale, original dated November 8th, 1859, is limited by the terms of the claim to the treatment of solid or liquid hydro-carbons, by first converting the volatile portions to vapor at a temperature below what is represented by iron heated to a cherry-red color, and then forcing the vapor so generated into contact with a red-hot surface, and instantaneously removing the gas to prevent destructive decomposition. Such is the process described for obtaining a permanent or fixed gas. An apparatus suitable for the purpose is described and represented, but not claimed: and in the re-issued patent No. 3,872, granted to the same parties (assignees of L. D. Gale, date of original November 8th, 1859), the same kind of apparatus is described and claimed in three claims.

"The first claim, according to its true legal construction, is limited to a combination of the vapor generator, with suitable means for supplying the hydro-carbon and the vapor-pipe leading into the decomposing chamber.

"This claim would be void for want of invention if it did not include in the combination the decomposing-chamber, because a retort with a feeder and pipe for conducting the vapor into a chamber is an old and well known device. The novelty consists in combining this with the decomposing chamber; and as the only decomposing chamber described is one in which the decomposition is effected by contact of the vapor with a red-hot surface, no party can be held to infringe this claim unless he uses, in combination with the vapor generator, means of feeding the hydro-carbon, and a vapor-pipe discharging the vapor into a chamber in which the vapor is decomposed by contact with a red-hot surface.

"The second claim is for the combination of a retort for vaporizing the hydro-carbon, arranged within an outer retort, the space between the two forming the decomposing chamber for effecting the decomposition by contact with the red-hot surface of the outer retort; and the third claim is limited to the combination of two or more vaporizing retorts with a gas-back or decomposition chamber, for decomposing by contact with a red-hot surface, and an exhauster for withdrawing the gas to prevent destructive decomposition.

* * * * * * * * *

"As to the patent granted to Nichols, Rand and Brown, assignees of Alonzo C. Rand, March 8th, 1870.—In this patent there are two claims: The first is limited to the combination of the vaporizer in which the hydro-carbon is vaporized, a super-heating chamber in which the vapor is superheated, and retorts in which the vapor is decomposed. And the second claim is limited to the combination of a test pipe with the subject matter of the first claim.

"In our opinion, neither of these claims would be infringed by the use of an apparatus such as is described in either of the two Dickerson and Whipple patents.

"It is proper that we should add that it frequently happens that parties who wish to infringe a patent for a useful invention, obtain a patent for something different, and under the pretence of using what they have thus patented, use something which does infringe. We are informed that parties working under the Dickerson and Whipple patent generate the hydro-carbon vapor and then pass it into a highly heated retort. If they do so, they infringe.

* * * * * * * * *

* * "We have received copies of several patents on which our opinion is requested.

* * * * * * * * *

"EIGHTH.—Letters patent granted to William Elmer, dated January 17th, 1865. In this the solid hydro-carbon is distilled at a temperature below that at which permanent gas is produced, and the hydro-carbon vapor so produced is passed through a highly heated retort containing zinc, or some equivalent material, for the purpose, as stated in the patent, of fixing the oxygen in the vapor contained in the water, or other products from the first retort. In our opinion the use of this would infringe the reissued process datent, No. 3,873.

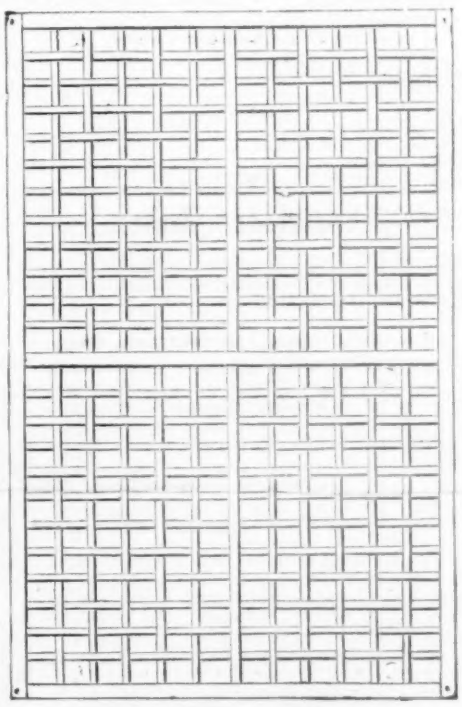
"We are clearly of the opinion that any party who shall manufacture illuminating gas from solid or liquid carbons, by first obtaining a hydro-carbon vapor, and then passing such vapor into contact with highly heated surfaces, or through a retort heated to a temperature above a cherry red heat will infringe the re-issue process patent, No. 3,873, and probably also the re-issue apparatus patent, No. 3,873.

"Respectfully yours,
(Signed) "KELLER & BLAKE."

REDUCTION IN THE PRICE OF GAS.—We learn that the Manhattan, New York, and Mutual Gas Light Companies of this city, have reduced the price of gas to $2.75 per thousand feet.

AMERICAN

GAS SCREEN MAN'F'G COMPANY.



TO GAS-LIGHT COMPANIES.

Your attention is respectfully called to the GAS SCREEN now being manufactured by the American Gas Screen Manufacturing Company, under the patents granted to E. DUFFEE, and are pleased to submit the following points of their excellence and superiority over all other screens now in use.

The Screen is made with an oak frame, interlaced with split rattan, drawn through holes at regular intervals in the Frame and cross-pieces, the edges of the frame being grooved to prevent abrasion.

The advantages of the screen are:

1st. The large purifying surface, the construction of the Screen giving over three-fourths of the surface for the gas to penetrate the lime.

2d. On account of the free passage of the gas through the Screen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

3d. The saving of lime and labor, as the Screens are not liable to clog, and are easily cleaned.

4th. Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any other now used.

Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

LUTHER DAY, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why they will not last for a long time. The *very large amount of open space* in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than when the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this fact of having *open Trays* would become more apparent to managers of gas works. The difference in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified, per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yours,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years, and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respectfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3, 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months, and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, Esq.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, Esq.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870.

EDWARD DUFFEE, Esq.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.,
SPRINGFIELD, MASS., Oct. 10, 1871.

Mr. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them. being able to purify over fifty pet cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. PISHON.

Address **A. P. JAQUES, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass.

CHARLES HUBBARD, JR.,

Consulting Engineer.

Steel and Iron Forgings, Light and Heavy Steel Castings to any pattern. Would call attention to his new article for Blacksmith's Forges, Jones's Patent Tuyere Iron, which is in successful operation in the leading establishments; can be used in any Forge now at work, or in combination with Jones's Improved Cast Iron Forge, plain or galvanized. Is prepared to furnish estimates of all kinds of Iron work used in the construction and carrying on of Gas Works, including supplies. Sole agents for A. L. Havens's Adjustable Automatic Dip Seal and Improved Retort Lids. Will give personal attention to the prompt execution of all orders. Address 60 Vesey Street, New York. 301

JAMES A. WHITNEY, late Editor of the *American Artisan*, and for four years past President of the New York Society of Practical Engineering, has opened an office as

Patent Agent, Expert in Patent Cases, and Mechanical Engineer,

AT NO. 128 BROADWAY, ROOM 11, NEW YORK CITY,

Mr. Whitney has had a practical experience of more than twelve years spent in pursuits directly connected with industrial operations and Patent Agency business, which will enable him to care for the interests of his patrons in the most satisfactory manner. 298

[*Continued from page* 82.]

convenient scuttles to its place below. The size of the coal house is 280 feet by 123 feet—storage capacity about 24,000 tons. The coal is hoisted by a steam elevator to the level of the retort house floor, thence on cars to the retorts.

The retort house is 200 feet by 68½ feet, surmounted by an iron frame truss-roof, covered with slate, and is a beautiful specimen of good workmanship throughout. The house is constructed with coke vaults, the nature of the ground admitting of that arrangement. The benches are built across the house in stacks of six, with six clay retorts to each bench. Next is the condenser room, containing a multitubular water condenser, a scrubber, and washer, and the apparatus of a complete experimental works, large enough in itself to supply a town of 5,000 inhabitants. Next is the engine room, containing duplicate boilers, behind them the fitting shop, then a vertical beam engine, the best that could be made; then the exhauster room with two McKenzie exhausters—one a 20-inch for the main works, the other a 12-inch for exhausting air back through the foul lime of the purifiers. Overhead is the meter shop and the carpenter shop, the latter filled with wood-working machinery. Next comes the purifying house containing four boxes, each 25 feet square, 40 inches deep, with six tiers of screens. The cellar is light and airy—very different from many cellars I could name. Next is the lime house. Then follow the offices, within which are the station meter, governor, jet photometer, and the various things necessary. This building is 55 feet front by 40 feet deep, two stories high, with cellar, and a tower containing a clock which can be seen from all parts of the works. The offices are finished in superior style and would do honor to any company. At the rear of the offices are two beautiful telescopic gas-holders, 112 feet diameter by 60 feet lift, capacity more than one million cubic. The yard also contains a small gas-holder for the experimental works—capacity 20,000 cubic feet. Only half the works as designed are now constructed, the balance will be added when required.

To one fond of the gas profession it is a real pleasure to visit these beautiful works. I am certain nothing in the country equals them in point of good taste, completeness, general excellence, and perfect adaptation to the end in view. The profession when visiting California should not fail to see them.

Since the City Gas Company started, another company making gas from petroleum by the Gale and Rand patents has also entered the field for business. It is the first time I have ever witnessed a triangular gas fight, and that it waxes hot you may know when I tell you that the price of gas has fallen from $4.75 to $1.60 per M., with a probability of its being still lower. Twenty candle gas is nightly furnished by all parties, and when I tell you that I hear their coal averages them $18 per ton, you may further know that there is not much money in the gas business here at present. It is a very pretty fight as it stands and consumers are joyful. How the war ends, what fish swallows the others, or what further aspects the fight may assume, you may hear from me hereafter.

A. B. C.

Novel Use for Balloons.

Mr. Samuel A. King, the well known Boston aeronaut, was recently employed upon a novel commission, that of measuring with balloons the discharge from a gas well in Bloomfield, Ontario county, New York. The well is owned by a company of capitalists, and the gas is conveyed in pipes to Rochester, twenty-six miles distant, and there mixed with the street or illuminating gas. The flowage has reached only 25,000 feet a day, when the capacity was estimated at 800,000. With two balloons, one of 20,000 cubic feet and the other of 13,000, the exact capacity of which was previously ascertained to a nicety, Mr. King measured the flow for a certain period, and the result showed that the flow was about 4,000 feet per hour. Much of the gas is thought to escape by leakage from the pipes between Bloomfield and Rochester. In accordance with Mr. King's suggestions, the company propose to perfect the present drill-hole and sink another near the first. The gas was discovered many years since while parties were boring for oil, and when it first escaped the tools were driven out.—*Evening Post.*

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

SEPTEMBER 2, 1872

DELIVERED IN NEW YORK.

English Cannel.			
Ince Hall	$13 50	@	14 00
Kirkless Hall	13 00	@	13 50
English Caking Coals.			
Newcastle Gas	$7 50	@	8 00
Liverpool caking	7 25	@	7 50
British Province Coals.			
International—At Mines, $2 00 in currency			— —
Block House—At Mines, $1 50, Gold			6 25
Little Glace Bay—At Mines, 1 60 Gold			— —
Pennsylvania Coals.			
Penn Gas Coal—At Amboy	$6 75	@	0 00
Westmoreland	6 75	@	0 10
Shafton	6 00	@	0 00
Youghiogheny—At Baltimore	5 50	@	0 00
West Virginia Coals.			
Murphy Run	$6 75	@	0 00
Despard	6 75	@	0 00
West Fairmont	6 87½	@	7 00
American Gas Coal	6 62½	@	6 75
Fairmont	6 75	@	0 00
Newburgh Orrel	6 75	@	0 00
Pinnickinick	6 75	@	0 00
Cloverhill of Virginia	5 25	@	5 50
McKenzie Compound Mixture			8 00
American Cannel Coals.			
Peytons of West Virginia	$14 00	@	14 50
Darlington of Pennsylvania			— —
American Cannel	$10 00	@	10 00
Asphalts.			
Albertite of New Brunswick	$18 00	@	18 00
Ritchie Mineral of West Virginia	17 10	@	00 00
Trinidad Bitumen	— —	@	14 05

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☞ In looking for advertisements, see figures 1 to 12, within brackets, at head of advertisement pages.

GAS BURNERS, APPARATUS, ETC.

American Meter Co.—West 22nd st., N. Y., Arch and 22d st., Phil., 23 West st., Boston. 6
Agency for the Gibson Improvement—W. H. Grenelle, 41 Pine street, N. Y. 9
Cast Iron Gas and Water Pipe—Smith & Ellis, York and Meyer streets, Phila., Pa. 4
Cast Iron Gas and Water Pipes—R. D. Wood & Co., Philadelphia Pa. 3
Cast Iron Gas and Water Pipe—Henry G. Nichols, 14 Platt street, New York. 5
Cast Iron Gas and Water Pipe—Jno. McNeal & Sons, 117 Broadway, N. Y. 2
Gas-Burners—C. Gefrorer, 259 Commerce st., Philadelphia, Pa. 6
Gas Purification—St. John and Cartwright. 6
Gas Meter Manufacturers—Harris & Bro., 1117 Cherry st., Philadelphia, Pa. 6
Gasometers, Etc.—Geo. Stacey & Co., Cincinnati, O. 3
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway. 4
Gasholders, Etc.—Deily & Fowler, 39 Laurel st., Philadel. 4
Gas and Water Pipes—B. S. Benson & Son, Allentown, Pa. 5
Gasometers, &c.—Keystone Iron Works—2132 Filbert st., Philadelphia. 4
Gas Screens—American Gas Screen Manufacturing Co., Haverhill, Mass. 1
Jersey City Gas Meter Works, 14 Morris st., Jersey, N. J. 3
Northwestern Gas and Water Pipe Co.—646 Wabash Ave., Chicago, Ill. 7
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Avenue C., N. Y. 5
Patent Gas Exhauster—Smith & Sayre, 95 Liberty street. 9
The Gas Light Co. of America—Box 5220, New York city. 4

GAS COALS.

Despard Coal Co.—Parmelee & Bros., Agents, 32 Pine st., N. Y. 4
Gas Coals—Bird, Perkins & Job, 86 South st., N. Y. 5
Grahamite or Ritchie Mineral—27 South Charles street, Baltimore, Md. 8
Ohio Gas Cannel—George Merryweather, 5½ Pine street, New York. 3
The Newburg Orrel Coal Company—Chas. W. Hays, Agent in New York, Trinidad Building, 111 B'way, Room 7. 5

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Atlantic Dock Iron Works—Hoy, Kennedy & Co., Office 98 Liberty street, N. Y., P. O. Box 2348. 3
Cast-Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md. 6
Continental Works—T. F. Rowland, Greenpoint. 5
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Sons 7
Gloucester Iron Works—J. P. Michellon, Sec., 6 North 7th street, Phila., Pa. 67
Louisville Pipe Works—Dennis Long, cor. 9th and Water sts., Louisville, Ky. 7
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman & Wilkins streets, Pittsburg, Pa. 5
Pascal Iron Works—Morris, Taskar & Co., Philadelphia. 19
Providence Steam and Gas Pipe Co., Providence, R. I.—H. A. Branch, Agent. 4

WATER METERS, PUMPS, ETC.

Cast Iron Pipes for Water and Gas—Riley A. Brick, 89 White street, N. Y. 6
Valves for Water, Steam and Gas—Ludlow Valve Man'g Co., 193 River street, Troy, N. Y. 5
Water Pipes, etc.—S. Fulton & Co., 412 Walnut st., Phila. 6

CLAY RETORT WORKS.

B. Kreisher, Clay Retorts, etc., 58 Goerck st., New York. 8
Clay Retorts, Fire Brick, Tiles, etc.—Wilson & Gardner, Lockport, Westmoreland Co., Pa. 8
Cheltenham Fire Brick and Clay Retort Works—Evens & Howard, 916 Market street, St. Louis, Mo. 5
Jersey City Fire Brick Works—J. H. Gautier & Co., Greene Essex and Bergen sts., Morris Canal Basin, N. J. 8
Laclede Fire Brick Works, 107 North Levee, St. Louis, Mo. 8
Manhattan Clay Retort Works, 15th st., near Av. C, N. Y. 8
Philadelphia Fire Brick Works, Vine and 23d sts., Phila. 8
Retorts, Etc.—Geo. C. Hicks & Co., Baltimore Md. 6

LAMPS, STOVES, PETROLEUM, ETC.

Patent Lamp Post—J. W. Graham, Chillicothe, Ohio, or A. M. Callender, office of this Journal. 9

MISCELLANEOUS.

Architect and General Gas Engineer—William Farmer, 111 Broadway Room 91. 3
A Synopsis of British Gas Lighting—Jas. R. Smedberg, San Francisco, Cal. 4
American Journal of Science and Arts—Silliman and Dana, New Haven Conn. 7
Contractors for Gas Works, Etc.—Murray & Baker, Fort Wayne, Ind. 5
Fodell's System of Bookeeping—A. M. Callender & Co., 42 Pine st., New York. 8
Journal of the Franklin Institute—Prof. W. H. Wahl, Franklin Inst., Phila., Pa. 4
On the Advantages of Gas for Cooking and Heating—Magnus Ohren, Lower Sydenham, London, S. E. 5
School of Mines, Columbia College, East 49th st. 5
Scientific and Chemical Expert—Prof. H. Wurtz, 26 Pine street, room 36, N. Y. 7
Screening Shovels—O. R. Butler, 126 Maiden Lane, N. J. 4
Works upon Gas—D. Van Nostrand, 23 Murray street and 27 Warren street, N. Y. 9

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MINED IN TAYLOR COUNTY, WEST VA.

Company's' Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of verr superior Coke, with little Ash, and scarcely any clinker. 304-1y

MARK LEVY,

Contractor and Builder of Gas Works,

OF THE LATEST IMPROVED PLANS.

No. 26 West 43rd Street, New York.

Patentee of a new process of manufacturing Gas from Wood, etc. 303-2t

WOOD GAS.

THE INVENTOR AND PATENTEE OF A NEW AND improved Retort for manufacturing Gas from Wood, Turf, etc., would call the attention of Gas Companies, and the public generally, to an invention which will be a great saving to the community, as they can thereby supply an exceedingly cheap, clear, and brilliant light, besides useful products in profusion.

Companies desiring to change from the Coal to the Wood process, or private individuals wishing to purchase rights for Hotels, Factories, Private Houses, Cities, Counties, or States, will be furnished with all necessary information, by addressing the Inventor,

MARK LEVY,
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FOR SALE—ONE GAS HOLDER CENTRE MAST, 68 feet diameter, 18 feet deep, 65,000 feet capacity. Thirty lengths Hydraulic Mains, with Dip Bridges, Stand Pipes and Mouth Piece complete. Apply to JAMES K. BURTIS, Secretary and Treasurer, or P. T. BURTIS, Superintendent and Engineer of Chicago Gas-Light and Coke Co. 301-3m

Prof. Henry Wurtz,

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Geological Explorations and Reports—Chemical Analyses—Advice and Investigations in all the Chemical Arts—Chemical Inventions and Improvements made.

[Prof. W. makes a specialty of GAS CHEMISTRY, and the Analysis of Gas and Coals. Formerly Chemical Examiner in the U. S. Patent Office Practices as

Patent Agent, Counsel and Adviser

of INVENTORS, in all the CHEMICAL ARTS; for which his great general experience in these Arts, and his special experience inside the Patent Office, have qualified him to an unparalled degree.

Prof. WURTZ is Editor of the AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY, a journal whose circulation and patronage is among classes of the community of the highest position, influence and enterprise; and which furnishes therefore an unequalled medium for communication to the general public of valuable inventions and novel enterprises.

For procuring British and other Foreign Patents promptly, and on moderate terms, Prof. W.'s arrangements are unusually complete and perfect. Inventors may assure themselves of the most *competent, diligent* and *faithful* attention to their interests.

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CHARLES MOWTON, Engineer New York Gas-Light Company, N. Y.
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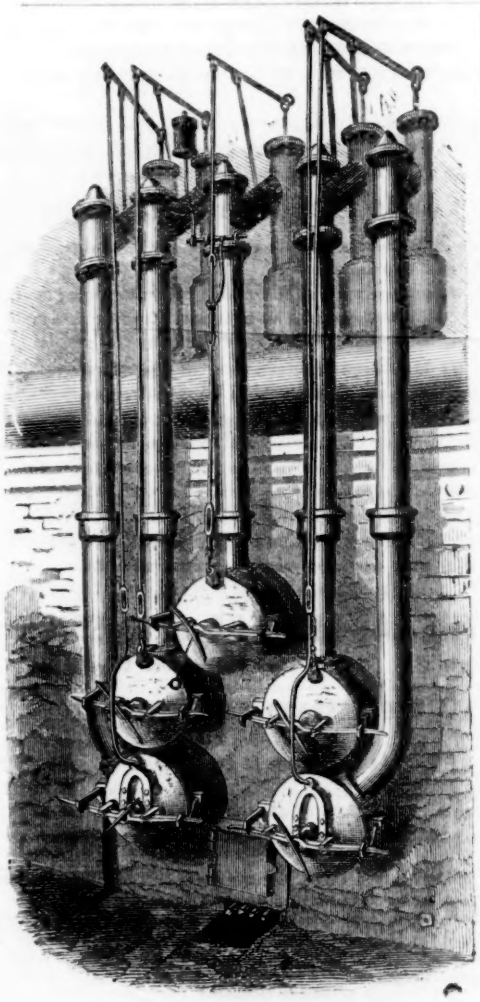
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal. [284-



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The Seal closes automatically, when the retort-lid is removed, and is broken by replacing the lid. No mistake can possibly be made. The rods are adjustable in a moment to any contingency. The new attachments are adaptable to any Works. Cost only that of rough castings. No lute used, and no leakage at lids. Half the number of lids only needed. Capacity of mains greatly increased. In new Works no mains. No carbon in retorts, seldom in stand-pipes. Address

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I am now prepared to place in the market, through my agencies as below, a regular and unlimited supply of this valuable Cannel, for gas purposes. A recent analysis, by Prof. WURTZ, Editor of this Journal, at the Laboratories of the NEW YORK GAS-LIGHT COMPANY, gave 47½ per cent of Volatile Matter and 45 bushels to the ton of a fair quality of coke. The yield of gas was at the rate of 9,500 feet per ton of about 27 candle power. It is not highly sulphurous, can be purified by Lime, and the ash from the coke does not clinker.

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We are now prepared to contract for this class of Castings under the most favorable terms.

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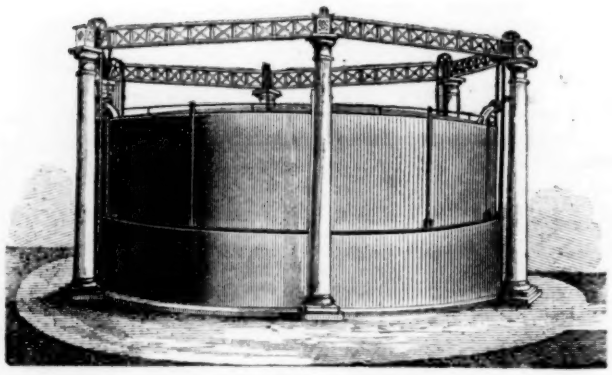

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SEVERAL THOUSAND 3, 4, AND 6 INCH CAST IRON GAS PIPES OH HAND, FOR IMMEDIATE DELIVERY.

☞ GAS WORKS CASTINGS OF ALL KINDS.

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MANUFACTURERS OF

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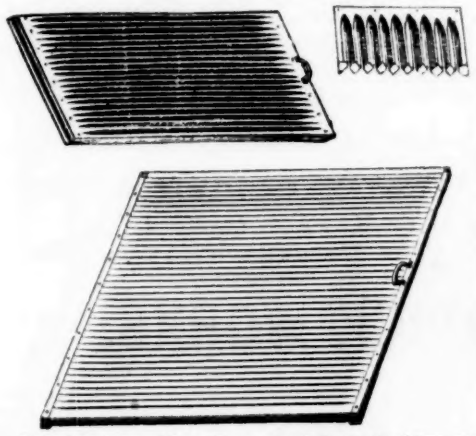

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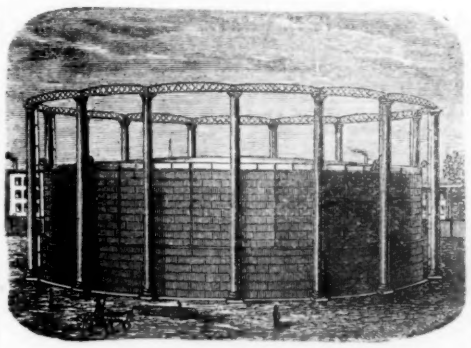

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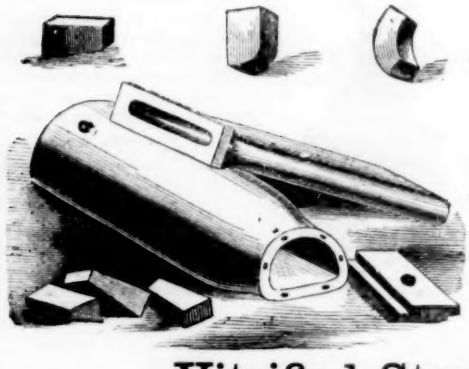

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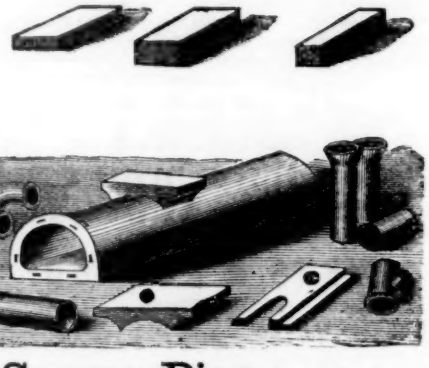

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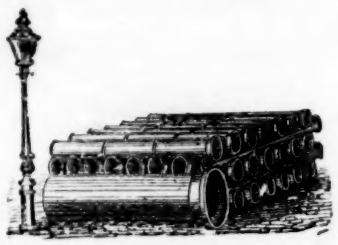

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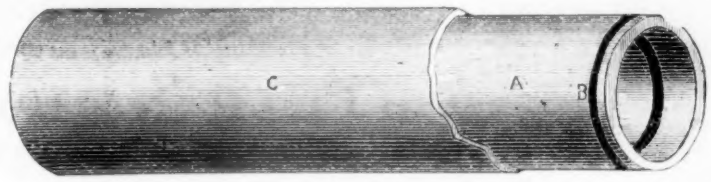

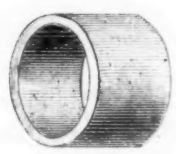

FIG. 2.

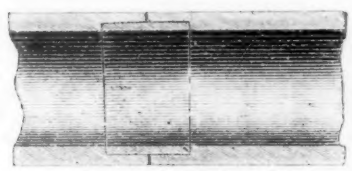

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

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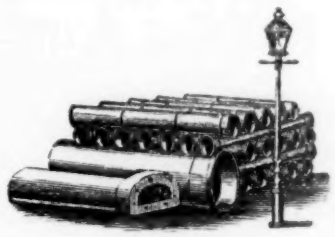

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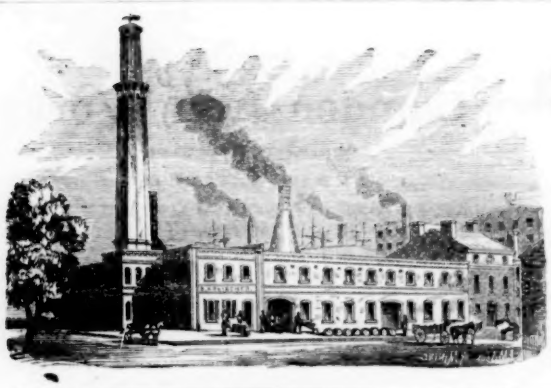

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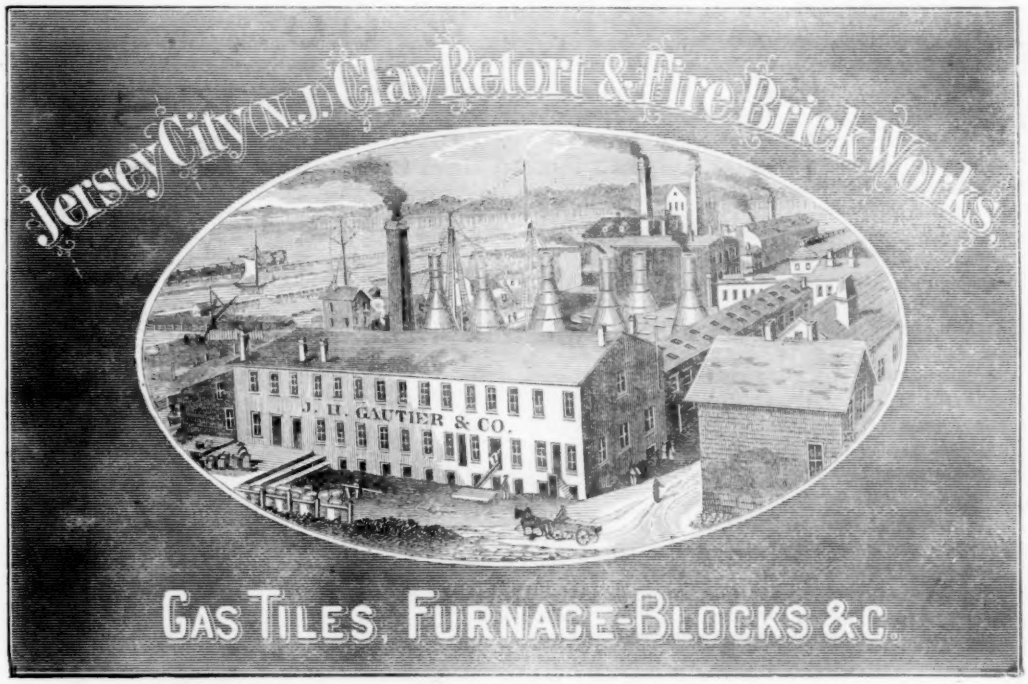

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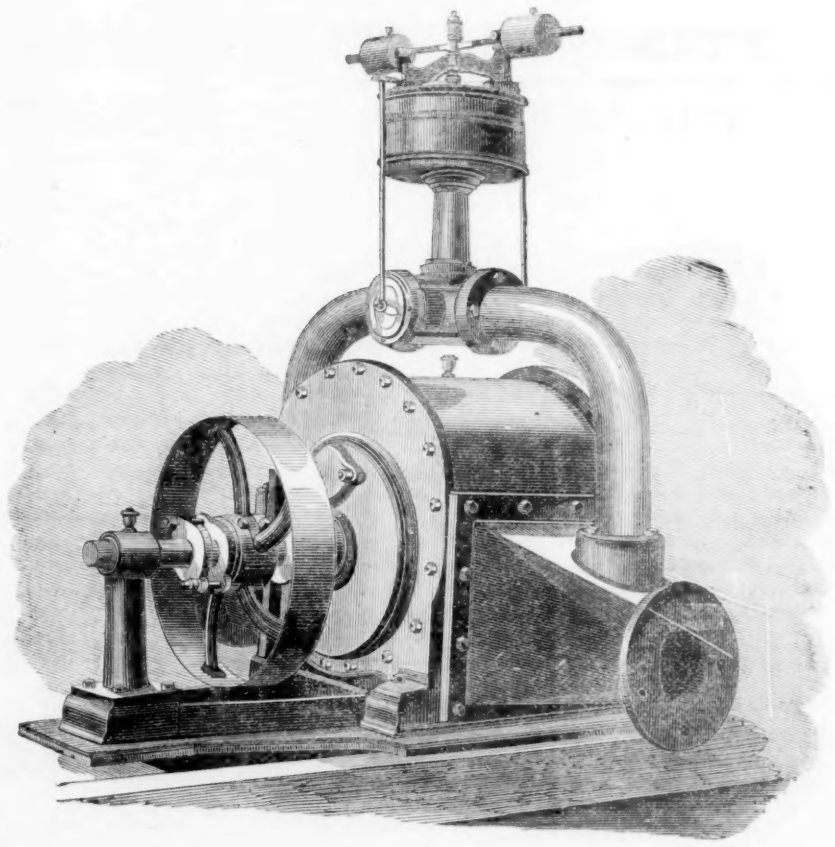

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not-liable to get out of order, self-acting, quiet, and certain in its operation.

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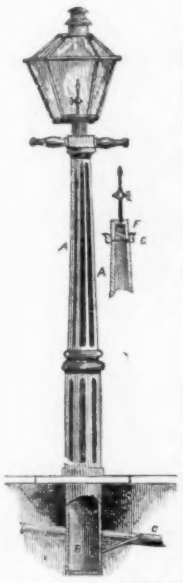

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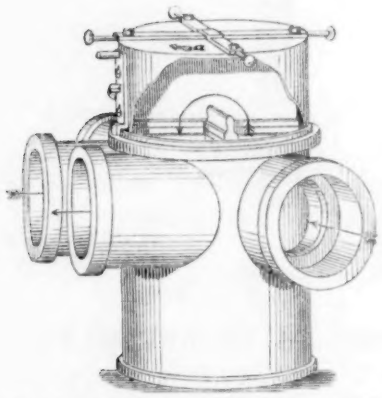

By Pass with Drip for Single Apparatus.

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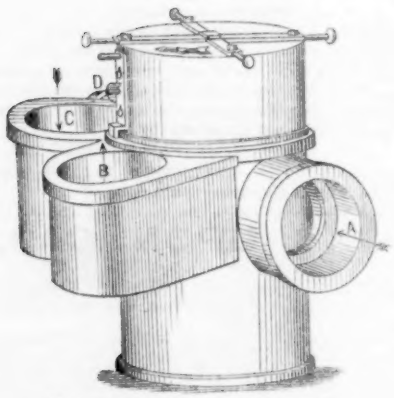

Meter By Pass with Drip.

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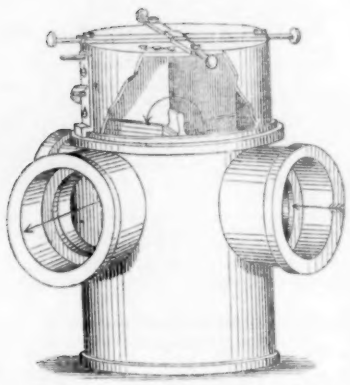

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No. 1 is a By-Pass for Gas Works of small generating power, and using but a single apparatus; the gas from the retorts enters the proper nozzle, as shown by the arrow, and being deflected by the diaphragm of the valve over one of the vertical partitions of the drip chambers, it passes through one of the nozzles to the meter and returns to be again deflected by the rotary valve to the gas holder.

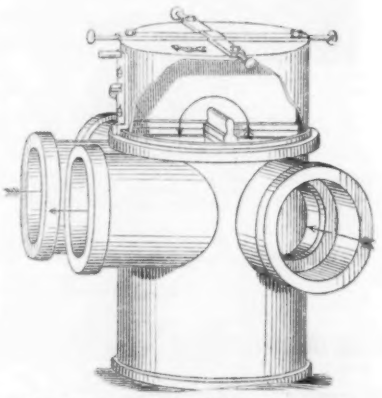
No. 2 is a By-Pass for using two apparatus, the gas is entered and the direction of its current is controlled similarly to that of No. 1, just described.

No. 3 is a By-Pass for passing the gas around the meter or not, according to the set of the loose or circular valve.

No. 4 is a sectional view of No. 3, and fully illustrates the construction and arrangement of the various By-Passes; the vertical partitions P are placed at right angles and divide the By-Pass into four drip chambers, they extend to within a short distance of the bottom to allow the water W, which forms the water seal, to circulate freely; the valve V is constructed with a diaphragm which divides it diametrically, the edges from ground joints with the upper edges of the partitions P, to prevent the gas from leaking from one chamber to another, and also to protect the ground surfaces from the corrosive action of the gas.

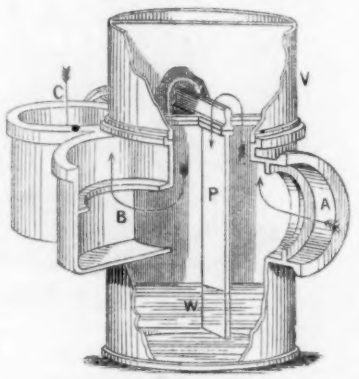
No. 5 is a single By-Pass with Drip Chambers.

No. 2.



By Pass with Drips for two Apparatus.

No. 4.



Section of No. 3.